SCIENTIFIC AMERICAN

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STANDARD PASSENGER LOCOMOTIVE.

Our engraving shows a standard passenger locomotive in use upon the New York, New Haven, and Hartford Railroad; it was designed by Mr. H. Kettendorf, who was, until recently, master mechanic of the road. The locomotive was built in the company's shops at New Haven.

The following are the dimensions:

Weight of engine and tender	65 tons.
Cylinders	18 in. x 24 in.
Drivers—diameter	5 ft. 9 in.
Length of frame	32 ft.
Boiler—steel, diameter	52 in.
Boiler—thickness of plates	7-16 in.
Fire box—length	6 ft. 6 in.
Tubes—steel, number	192
Tubes—length	11 ft.
Tubes—diameter	2 in.
Steam port—length and width	15¼ in. x 1¼ in.
Exhaust port—length and width	15¼ in. x 2½ in.
Lap—outside	⅞ in.
Lap—inside	1-16 in.
Throw of eccentric	4¾ in.

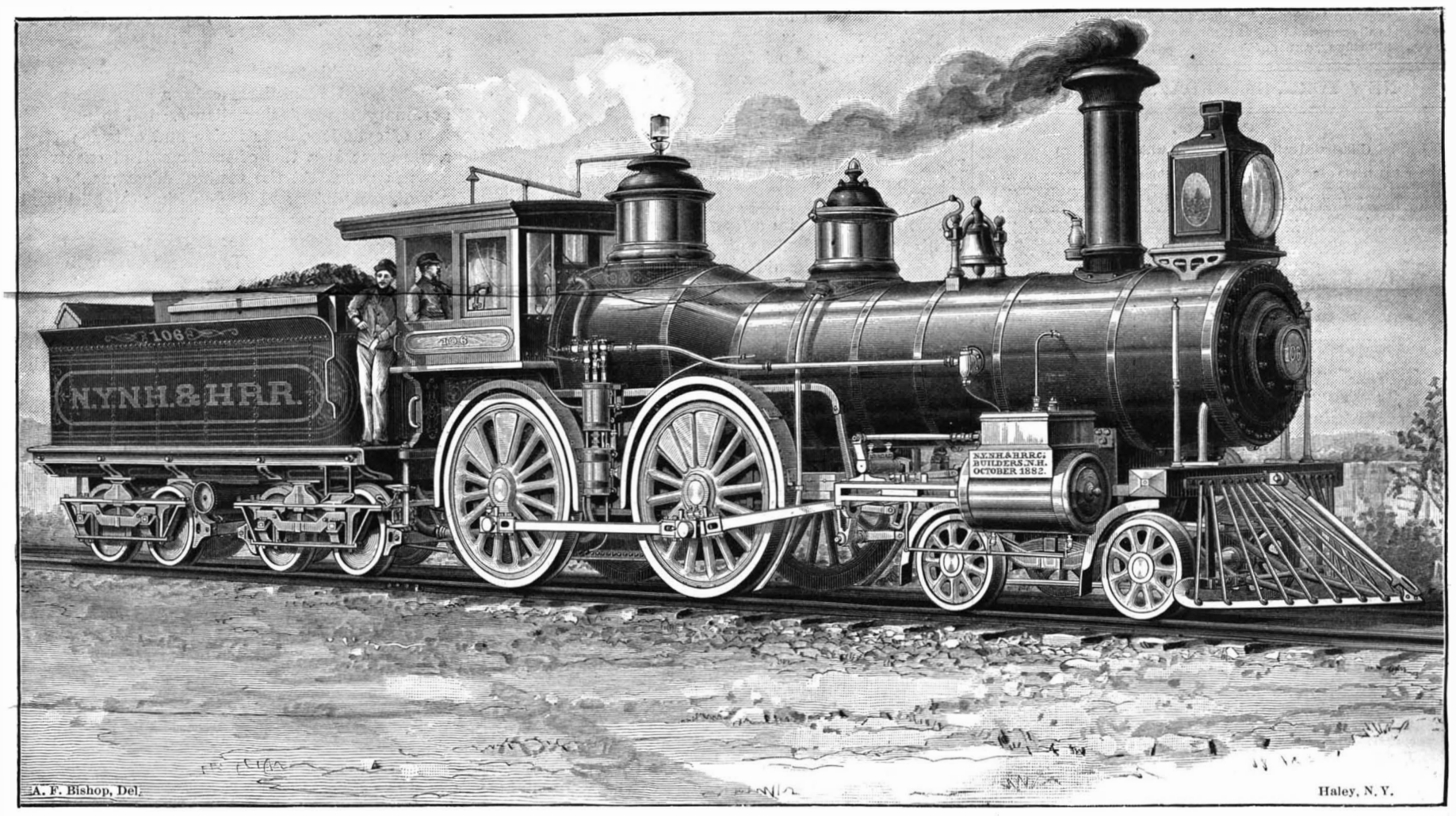
The locomotive, while not overloaded with polished work, presents a most attractive appearance; the frame is finished throughout its whole length. It is admirably proportioned, and capable of great and continued speed. The records of these engines show that their visits to the repair shop are few and far between, thereby indicating their mileage is at the maximum, while they incur a minimum expense for wear and tear.

The Mount Washington Railway.

The recent death of Sylvester Marsh, the eminent engineer and inventor, at the age of 81 years, recalls his work in the design and construction of the Mount Washington Railway. This is the highest of the White Mountain range in New Hampshire, reaching to an elevation of 6,293 feet above the sea, and is a noted summer resort. Years ago the summit was reached by a difficult bridle path, nine miles in length. Later, the mountain was scaled by a good carriage road, which was laid out so skillfuly that with an average grade of 12 feet to 100 feet the maximum was 16 feet to 100 feet. In 1852, while lost upon the mountain, Mr. Marsh conceived the idea of building a railway to the summit, but the opposition to what was considered to be a chimerical scheme prevented the granting of a charter until sixteen years later. At the time of the final passage of the bill, an amendment was offered to permit the construction of a railroad to the moon. The opposition which early railroad constructors met with in the form of mobs was here exhibited in the less tangible form of ridicule. The road was finished in 1869, at a cost of $150,000.

The mountain road is constructed on trestles, 2 1/16 miles in length, with an average grade of 1,300 feet to the mile and a maximum grade of 1,980 feet to the mile, or a yard to every 8 feet. It contains nine curves, with radii varying from 497 feet to 945 feet. The first plans were designed to have the cars drawn by ropes, but this idea was abandoned for a track with a middle rail, which consisted of a rack made of two 3 inch angle irons, about 5 inches apart, and connected by round iron rods, 1½ inches in diameter and 4 inches between centers. The locomotive weighs 6½ tons, and pushes the cars ahead, the driving wheels having gears which engage in the central rack. The center rail is used by venturesome persons at all seasons of the year, with a sled formed of a board having two parallel guides to grasp the middle rail, and having a lever to increase this grasp whenever the use of a brake becomes necessary. The speed of such a sled is terrific, the descent of the mountain having been accomplished in this manner in seven minutes. A man on one of these sleds descends the track in advance of every down train, thus embodying a practical realization of the illustrated advice given by *Punch* a number of years ago, to stop railroad accidents by tying a couple of directors to each locomotive.

In descending trains air is let into the cylinders and the exhaust throttled, to provide a suitable resistance to the progress of the train. The heat produced by the work done in this compression of the air is absorbed by the admission into the cylinders of a spray of water, which as it comes from the exhaust pipe is converted into vapor, and presents the appearance of an escape of steam from the boiler. The extraordinary precautions which have enabled this road to carry passengers without a single injury during the fifteen years that the line has been in operation may best be illustrated by the answers of a conductor to the timid lady who asked how they kept the train from running down. He answered that it was accomplished by the pressure in the engine cylinder. The question was further urged as to the consequences of the failure of this method, and in answer to repeated questions the man gave information respecting the brakes gripping the middle rail, the power brakes upon the wheels, and the hand brakes for the same purpose; and also the pawls which drop into the rack constituting the middle rail. And then she persistently asked what would happen if all these failed? "That is a question of theology, madam!" he replied.



STANDARD PASSENGER LOCOMOTIVE OF THE NEW YORK, NEW HAVEN, AND HARTFORD R.R.

Three Colors in One Bottle.

For the bottom layer glycerine may be used, or colorless glucose sirup, or any other colorless liquid of high specific gravity. These may be colored by chromic acid, picric acid, indigo blue, caramel, or some aniline color. The middle layer may be water, for the coloring of which any water-soluble color may be chosen. The kind of color depends upon individual fancy. For the top layer oil of turpentine or naphtha may be selected. But it should be remembered that both of these liquids and their vapors are highly inflammable; hence the close proximity of a gaslight, as is customary with show-bottles, involves a certain amount of risk. A better plan is to use turpentine as the middle layer and alcohol as the top layer.

Sometimes cudbear and alkanet have been recommended for coloring the turpentine. The coloring matter of the former, however, is nearly insoluble in the liquid, and the latter only slightly soluble. It is much better to use a resinous substance, such as dragon's blood, or one of the vegetable oleoresins, which are quite resisting to daylight, as, for instance, oleoresin of capsicum, which imparts a reddish to reddish-yellow tint; or oleoresin of male fern, which imparts a greenish tint.—*American Druggist.*

Artistic Photography.

One of the finest and most picturesque scenes yet produced by the camera is a flock of sheep, grazing on the campus in Central Park. There is a pleasing variety in the attitudes of the animals, and although the number is large, each is a perfect portrait. The picture forms a study for the artist. The negative was made by Mr. Henry J. Newton, member of the New York Society of Amateur Photographers.

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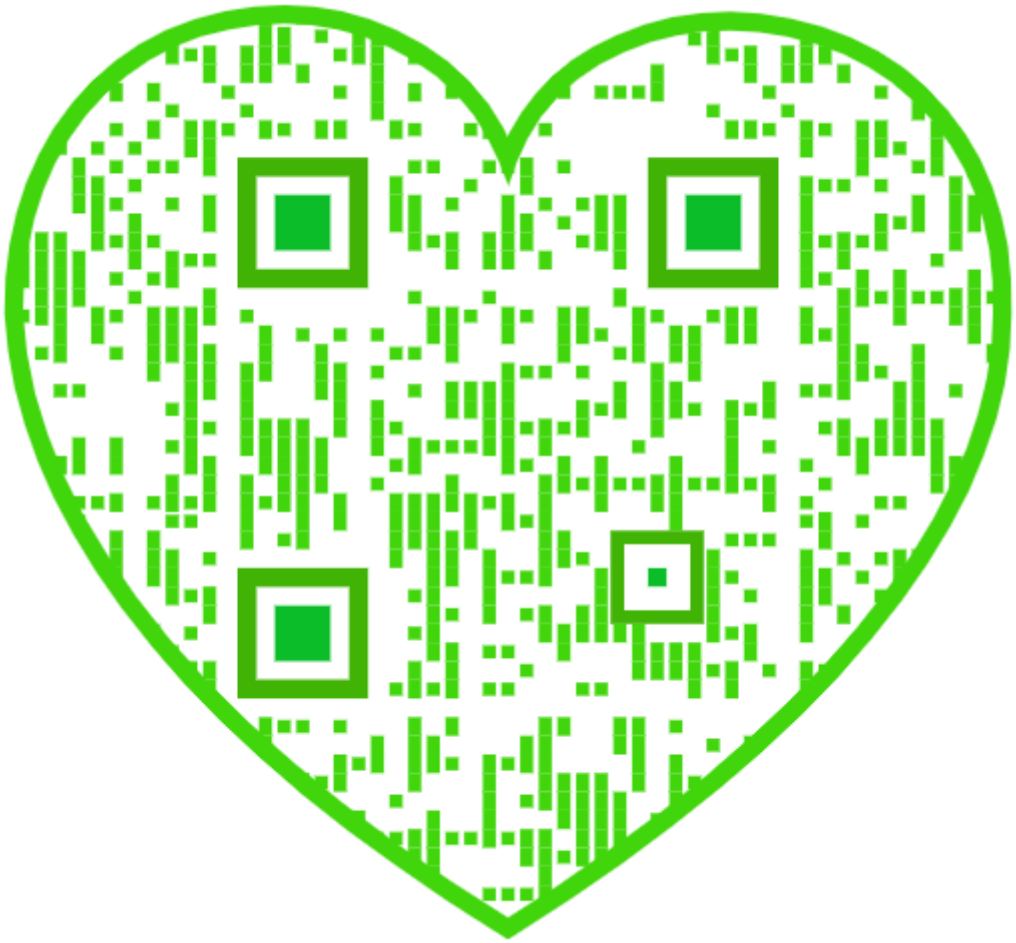

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NEW YORK, SATURDAY, MAY 16, 1885.

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TORPEDO SWIMMERS—OLD AND NEW.

For some days past the British war steamer Garnet has been lying at anchor in the harbor of New York, her officers and crew the recipients of the usual hospitalities accorded to visitors from friendly nations. In view of the various dynamite outrages that of late have been perpetrated, especially in London, it was rumored the Garnet was especially guarded with a view to prevent any secret attempt at injury to her hull. This rumor led Captain Paul Boyton, the famous swimmer, to undertake a practical test of one of his theories. It has long been maintained by him that by his swimming suit he can approach any vessel, however well guarded, and can fasten a torpedo to her bottom, and get away to a safe distance from which to view her destruction. He believes it hardly possible to detect him, and possible only after the work has been done. Torpedo warfare, conducted by the regular torpedo boat, is confessedly hazardous and costly. Several lives are exposed and several thousand dollars risked at each attempt. But Boyton's method of swimming out to a vessel, sinking underneath her, rising at the end that cuts the tide, and fastening his deadly and timed machine to her anchor chain, exposes only one life, risks only a few dollars of value, and accomplishes, with fifty times the certainty of any other scheme, a destruction sure, terrible, and complete. On the night of May 5 last the gallant Captain, who, by the way, is an Englishman, undertook to show to some of his friends the correctness of his assertions. According to the *Tribune*, he provided himself with the shell of a torpedo of the usual pattern, about two feet long, with clockwork at one end so arranged as to set it off five minutes after the machinery was started. It was loaded with little cracked stones instead of explosive material. It contained air chambers of sufficient size to float it easily, and was supplied with about ten yards of rope with which to tow it and to tie it up against the ship. The rope was slipped around the swimmer's foot, and he started off from the Staten Island shore toward the Garnet, half a mile or so distant.

As the swimmer approached the war vessel, he expelled the air from his suit and sank deep into the water, drifting with the tide under the ship, and reappearing near her anchor chains at the starboard bow. He reconnoitered gingerly about this perilous spot. If he was detected, the probability that they would shoot first and inquire afterward was fully impressed on his mind. He had no disposition to submit himself to this risk. He could hear the men in the bows whispering faintly, and the heavy plod, plod, of the watches on the decks. Finally he touched the anchor chain. He came nearer and nearer, and grasped it with his hand. Drawing his foot up, he undid the knot which had held the torpedo in tow, and carefully threw the rope over the anchor chain. He drew its end toward him, and tied it securely in three knots. Then he swam down to the torpedo, and placed it against the vessel on the starboard side just amidships. He shoved himself off. In five minutes more, had the torpedo been charged, the Garnet would have been blown up.

This recent midnight prank of Boyton's recalls the attempt of Sergt. Lee, of the American army, to blow up Lord Howe's flagship Eagle in the same waters in 1776. It is curious to note how closely that earliest attempt to use a submerged torpedo in actual warfare was imitated by Boyton, save that he was clad in rubber instead of oak, and loaded his torpedo with broken stone and an advertising card instead of gunpowder and means for exploding it. Both adventurers meant business, but not precisely in the same sense.

Sergt. Lee operated a torpedo boat invented by David Bushnell, afterward captain in the patriotic army. It had been tried with some success experimentally, and gave promise of being useful in serious warfare. The first opportunity for such use was offered when the British fleet of 37 men of war and 400 transports took possession of New York harbor. The fleet lay in the lower bay, just inside Sandy Hook.

From the description given of the Bushnell boat, it would seem to be more like a barrel than a boat. It was of oak, iron-banded, and only large enough for one person. When floating upright, the navigator's head was a little above the level of the water. By means of two force pumps, worked by the occupant's feet, the vessel could be made to sink or rise in the water, by forcing water out or in, and so changing its specific gravity. Its progress horizontally was governed by two revolving paddles in front, turned by a crank inside. The torpedo was fastened to the back of the boat by a screw, the release of which set in motion a clock connected with a gun-lock and flint. After the predetermined interval of time had elapsed, the clock would strike and ignite the powder.

The torpedo carried by Lee against the Eagle was charged with 150 pounds of powder (some say 130 pounds), and the clock was set to explode the charge in thirty minutes after the torpedo was placed. Lee was towed to the neighborhood of the fleet by a party in whale-boats, and then proceeded to attack the fleet alone. He succeeded in reaching the Eagle, a 64-gun ship, undetected, and spent a long time in a vain attempt to fasten the torpedo to her bottom with hooks and screws; a band of iron at the edge of the copper sheathing proving an especially serious obstacle. As daylight approached, he was compelled to leave the fleet and return to the city. Off Governor's Island he was intercepted by a British barge, when, to avoid capture, he exploded his torpedo, escaping from his pursuers during the panic which the explosion excited.

A Bushnell torpedo boat was used more successfully a year later in the harbor of New London, Conn., where a prize schooner, in charge of the man-of-war Cerberus, was blown up and destroyed.

As an act of discourtesy to a friendly visitor, Boyton's prank has little to commend it. As a practical demonstration of a new risk to war ships at anchor, even in a friendly port, it has a different and wider bearing. Bushnell's idea of matching one man against a ship may, after all, be the true one. It is obvious that one torpedo placer, able to swim Boyton-fashion on or under water, is much less liable to detection than a torpedo boat, and much less easily guarded against; for he could approach unseen and pass under the booms and networks which suffice to explode or ward off torpedoes of the usual sort. If Sergt. Lee's torpedo had been provided with a strong magnet, the strip of iron which thwarted him would have insured the success of his undertaking, and the use of torpedoes in naval warfare might have been hastened half a century, materially changing the current of more recent naval and political history.

RELATIVE MEASUREMENTS.

Every draughtsman, architectural or mechanical, knows the difficulty of making divisional spaces come out a complete whole; it is very difficult to complete a whole from subdivisions. Yet this is what modern practice in machinist work has accomplished—indeed, it is what the requirements of modern metal manipulation demand.

It may be possible to divide a linear measure into fractional parts, and have these make a complete whole with ordinary mechanical appliances; but to make diameters of cylinders, their inside and outside dimensions, the same is a test of mathematical exactness. Yet this is done. At the testing department of a prominent machinist and tool-making establishment the integrity of the gauges was shown by some singular tests. The gauges for diameters are plugs and templates of hardened steel. (Templates mean, in this connection, rings or disks with a bored and finished hole to receive the plug.) So closely are these fitted that a differing temperature corresponding with the warmth of the human body is sufficient to disturb the relative sizes. For instance, a template (ring) in the testing room, where a four-foot gas burner was lighted, was tested with a plug in a glass cabinet against the wall. The temperature of the cabinet as compared with that of the testing room varied eight degrees by thermometer, and yet the fits were so close that this variation affected the movement of the plug through the template.

But the most exactive test of relative measurements were given with these plugs and templates. A template or ring of just one inch diameter of hole would receive a plug of exactly one inch, both being of the same temperature. Then it was suggested that the relative measurement should be tested, and two half inch plugs were introduced side by side, inside the one inch template or ring. Would it be believed that those two half inch plugs held the ring as surely as would have held the solid one inch plug! Yet this was proved by repeated tests. In fact, the impinging of the two half inch plugs on the inside diameter of the template ring and on each other's diameters represented only infinitesimal lines, but the bearing was perfect. Another test of exactness in divisional measurements was that of taking, at a chance, a template (or ring of hardened steel), that had an interior diameter of two and one-sixteenth inches. Trials were made to place, side by side, a one inch plug and one of one and one-sixteenth. It is wonderful to say that they fitted exactly! And a still stronger test was made with a template of the same size—two and one-sixteenth inches. The test was made by placing three plugs, one of one inch diameter, one of half an inch diameter, and one of nine-sixteenths of an inch, aggregating thirty-three sixteenths, or two inches and one-sixteenth. These varying plugs exactly filled the diametrical space in the template which a single plug was to fit. Such measurements as these are close enough for very fine work; but they are demanded by the exactions of modern machinist production.

DURING the month of April last the Patent Office received 3,159 new applications for patents, the fees upon which aggregated $100,640, and yet Congress refuses, session after session, to grant a sufficient appropriation to employ a large enough clerical force to keep up the business of the Office. This is the largest sum in fees yet received by the Patent Office, the nearest approach to it being in the month of March, 1883, when the fees footed up $99,515.

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ELECAMPANE AS AN ANTISEPTIC.

Among the familiar roadside weeds of the Northern States, the rough-stemmed, yellow-flowered elecampane is as conspicuous as any. Though less aggressive and troublesome than thistles, burdocks, and some others in the list of European migrants, the elecampane is regarded with little favor by farmers, in spite of the well attested medical virtues of its roots. It is by habit a vegetable tramp—a weed; and with the least encouragement it has traversed every highway and by-road from Maine to the Mississippi, straggling into fields and meadows wherever suitable conditions of moisture and fertility promise for it, what all tramps go for, a plenty of easily acquired food. It was originally brought to this country as a garden or door-yard plant, partly for its gaudy flowers, partly for its utility in domestic medicine; but for many years it has been held in little esteem on either account, more through change of fashion, however, than for any fault of the plant. Indeed, it now appears that, like many another victim of popular neglect, the elecampane is worthy of restoration to public favor, and may in truth prove to be justly reckoned among the most useful of useful plants.

In a recent issue the *Lancet* mentions a series of articles which have appeared lately in a pharmaceutical paper of Barcelona, describing investigations which go to demonstrate that the chief active principle of the elecampane, *helenina* (from the systematic name of the plant, *Inula helenium*), is one of the most powerful antiseptics known, and at the same time free from the disagreeable odor of carbolic acid, which it might well replace.

It is not clear whether *helenina* (as the *Lancet* spells it) is the *helenin* of Gerhardt ($C_{21}H_{28}O_3$), obtained by extracting the active principle of elecampane with hot alcohol, in the form of needle-shaped crystals fusing at 72°, or the *helanine* of later chemists ($C_{12}H_{16}O_2$), which results from repeatedly recrystallizing the crude extract and separating from it inula-camphor ($C_{10}H_{16}O$). The latter fuses at 64°; *helanine* at 110°. As thus purified *helanine* is described by Watts as colorless, inodorous crystals, nearly insoluble in water, and easily soluble in alcohol. In the U. S. Dispensatory this compound is described as intermediate in its properties between essential oils and camphor. Inula-camphor is isomeric with camphor, and strongly resembles menthol, or peppermint-camphor, now a fashionable remedy for headache. The essential oils nearly all possess the composition $C_{10}H_{16}$; and, as Prof. Mantegazzi showed in 1870, their oxidation when exposed to light is a powerful and convenient means of producing ozone, giving them high value as disinfectants.

Thus from what is well known of helanine and its allies, it is not surprising that it should be valuable as an antiseptic. The investigations first referred to seem to have been suggested by those of Dr. Korab, who found one part of an alcoholic solution of helanine sufficient to arrest putrefaction in ten thousand parts of urine; also that a few drops of the solution immediately killed the organisms in ordinary infusions, and also in cultivations of tubercle bacillus.

The writer in the *Boletin Farmaceutico* applied an alcoholic solution of helenina to slices of veal, which, though kept at a temperature of 28° C. (82·4° Fah.), remained sweet for ten days, or until completely dry. An egg beaten up with nearly a pound of water was treated with 5 grains of helenina in six times its weight of alcohol remained unchanged for six days at a temperature of 82°. Another egg similarly beaten up with water, without the drug, rapidly decomposed, and in twenty hours emitted a strong odor of sulphide of hydrogen. When to this solution about 8 grains of helenina were added, the offensive odor quickly disappeared, and the mixture underwent no further change.

Similar experiments with urine, meat, and beaten-up eggs were made with carbolic, boracic, and salicylic acids instead of helenina; but much larger proportions of the acids were required to prevent putrefaction, and none of them was able to arrest putrefaction already begun, as the helenina had done. It was also observed that the aromatic smell of the materials from which the drug was extracted repelled all insects, even mosquitoes, from the house in which the experiments were made.

The *Lancet* adds that helenina has proved valuable in surgery as an antiseptic when carbolic acid and all other agents had failed; also that it has been given successfully in malarial fevers, and tuberculous, infantile, and catarrhal diarrhœa; and that it is expected to form an excellent substitute for carbolic acid in the Listerian system of aseptic surgery. Possibly the power of the drug to kill low organisms is what has made it useful as an internal and external remedy in tetter, psora, and other diseases of the skin, as mentioned in the Dispensatory. In this country it has been chiefly used of late in chronic diseases of the lungs. It is said to be sometimes beneficial when the chest trouble is attended with weakness of the digestive organs or with general debility. The ancients employed elecampane root very largely in medicine, and it would seem to be still more generally used in Europe than in America. If its alleged antiseptic and germicidal properties are confirmed by further tests, it is probable that the despised weed may rank the cinchona tree in sanitary and commercial importance.

The clever definition, "*Weed.*—A plant whose uses are not discovered," thus receives a new and striking illustration. Who can tell how many other old weeds are awaiting new uses, to justify their persistence in living?

Elecampane is a coarse-looking plant; the stem, rising to six feet, is furrowed, branching and downy above. The radical leaves are very large and rough, with serrated edges. The upper leaves are smaller, and embrace the stem. The flowers, which appear in July and August, are in heads, like sunflowers, and stand singly at the ends of the stem and branches. Their color is a golden yellow; odor aromatic. The stem is renewed every year; the root is perennial. The fresh root is very thick and branched, having whitish cylindrical ramifactions with thread-like fibers. The outside is brown; within, the root is whitish and fleshy. The agreeably aromatic odor of the root is increased by drying. The roots are dug in the fall, and are best in their second year; when older, they are apt to be woody. The dried root can be procured in almost every drug store, and might be worth trying as an agreeable and possibly efficient means of keeping apartments free from flies, mosquitoes, and other insects. The ozonizing power of the odor is likely to be valuable also in helping to destroy bad smells, even if the active principle should be less efficient than the Spanish authorities affirm in preventing putrefaction and like unsanitary processes.

It may be worth while also to encourage the growth of the plant around outhouses, ditches, and drains, instead of the now fashionable but coarser and less efficient sunflower, for the purifying of the air and the prevention of malaria.

FACTS ABOUT CHOLERA.

The original arrival of epidemic cholera upon this continent is by most authorities set down as June 3, 1832, when the ship Carricks arrived with emigrants at Grosse Isle quarantine station in the St. Lawrence. A score of years later, however, during another visitation of cholera to these shores, Dr. Westervelt, the then Health Officer of the Port of New York, acknowledged that in 1832 cholera had arrived at the port of New York in infected ships prior to its outbreak upon the St. Lawrence, but that for prudential reasons the facts had been suppressed by the Board of Health. "The sick," he said, "were cared for in the quarantine hospital, and the *well* emigrants were shipped rapidly from the city." The infection was brought from the St. Lawrence by emigrants into New York State, and met the line of infection then advancing northward from New York city. Thence it was spread here and there throughout the country.

In 1848 the cholera was brought hither by two ships, the one arriving at New York, the other at New Orleans. Both ships came from Havre, which was regarded as free from cholera, and both ships had a clean bill of health. A portion of the emigrants aboard these vessels came, however, from infected places in Hungary. Very excellent circumstantial evidence that the cholera germ may readily be carried safely for thousands of miles in the luggage of emigrants is furnished by the reports of the masters of these two vessels—the Swanton, bound for New Orleans, and the New York, bound for New York city. The first says there was no cholera aboard his ship until, an unusually hot wind having begun to blow, the emigrants overhauled their luggage for thin clothes; and the master of the second ship says that it was while the emigrants aboard were searching their dunnage for thick clothes to withstand a sudden cold blast that the first symptoms of the disease first appeared.

During the years 1851, '52, '53, and '54, cholera broke out in several parts of the country, being in every instance directly traceable to the luggage of emigrants coming from infected portions of the Old World. Toward the end of October, 1865, the steamer Atalanta arrived in the port of New York from Havre with six hundred passengers, among whom cholera was raging, and the Hermann arrived a few days later under similar circumstances. Cholera was then raging in both Marseilles and Paris, and all these passengers had come thence. A nurse on the hospital ship at quarantine visited Ward's Island, and in eleven days there were thirty-one attacks and eighteen deaths. This made the time of traveling for the cholera germ only nine months from Bombay to Ward's Island *via* water and land routes.

Dr. McClellan, in his narrative of the epidemic of 1873, says: "Three distinct outbreaks of cholera occurred at widely remote points in the United States from poison packed and transported in the effects of emigrants from Holland, Sweden, and Russia.

"These people and the vessels in which they were carried had been perfectly healthy, and the people remained so until their goods were unpacked at Carthage, Ohio, at Crow River, Minn., and at Yankton, Dak., respectively. Within twenty-four hours after the poison particles were liberated, the first cases of the disease appeared, and the unfortunates were almost literally swept from the surface of the earth."

As to the intensity of cholera, a very excellent authority, Libert, says:

"Nothing can be more capricious than the variation in the intensity of cholera in different places and at different times, even at different times in the same places. An imported case may end in a local attack, confined to a single room or house; even a simultaneous importation of a number of cases at different points may exhaust itself in a number of local epidemics, while at other times a single case suffices to swiftly produce an epidemic or even a raging pestilence."

A careful study of previous epidemics shows that there is little danger from that which, like rags, must pass under customs inspection. It is the emigrants themselves, and especially their luggage, which should receive the most attention; and from the evidence at hand it may safely be laid down as uncontrovertible that as long as this dunnage, or even a part of it, is permitted to enter the country during the prevalence of epidemic cholera abroad, we may at any moment expect to hear of its outbreak here, if not at the port of New York, at other points whither emigrants landed here have been dispatched.

Oil in Storms at Sea.

The Hydrographic Office of the Navy Department has for several months been engaged in collecting data to determine under what circumstances the use of oil is most efficacious in diminishing the danger of breaking seas during gales of wind. When sufficient data have been collected, it is proposed to issue a pamphlet giving such directions in regard to the use of oil as common experience of seamen may determine to be best.

The following are among the most striking of the accounts recently received:

In November, 1881, the steamship Venice, from Savannah to Europe with cotton, while running before a heavy northwest gale was boarded by a tremendous sea. The captain determined to heave to, and men were stationed to pour oil down the closet chutes forward and to throw waste, soaked in oil, to windward. The vessel came round without shipping any water. As she kept falling off, it was concluded to put her again before the sea, which was done without trouble, and it was found that she kept perfectly dry as long as the oil was used. Again, in January, 1884, while crossing the Atlantic to New York, after running before a northwest gale for some time, she was laid to without difficulty or danger by using oil in the manner stated.

Captain Ritchie, of the English steamer Fern Holme, while on his last voyage from Baltimore to Shields used oil bags while running before a west-southwest gale. He hung one over each side, just forward of the bridge, and they prevented the ship from taking water on deck.

First Officer W. Maltjen, of the German steamer Colon, in December, 1884, used oil bags with remarkable effect. Two bags filled with boiled oil were hung over the bow. The oil spreading over the surface prevented the waves from breaking, and the ship rode quite easily during the continuance of the gale.

Captain Jones, of the British steamer Chicago, while rescuing the crew of the brig Fedore, used oil with best results. It was blowing a heavy gale, with very high seas. The Chicago ran to windward of the Fedore, and during a lull, oil having been poured on the water, the port lifeboat was successfully launched and started. A can of oil was taken in the boat, and by using this the seas were kept down in the immediate vicinity, though they broke in masses of foam a short distance away. As the boat approached the Fedore, the crew of that vessel poured oil on the water, which so calmed the sea that the boat got alongside and rescued the shipwrecked crew without sustaining any injury. About half a gallon of oil was used by the boat during her trip.

The brig P. M. Tenker, Captain Charles Barnard, New York to Cuba, in 1872, encountered a northeast gale when four days out. Several heavy seas came on board, doing great damage. A small bag, with holes punched in the bottom, was filled with oil and hung over the stern. The oil prevented the seas from combing, and the vessel ran for several hours with dry decks.

The Ornithorhynchus.

In the SCIENTIFIC AMERICAN of March 15, 1884, appeared illustrations and a very interesting description of this queer little animal with an unpronounceable name, prepared by Mr. L. P. Gratacap, an attache of the American Museum of Natural History in this city. Doctor H. A. Ward, collector of zoological specimens, has recently returned from Australia, where he has been in behalf of the museum, and brought back thirty of the ornithorhynchus. This strange animal is the connecting link between birds and mammals. It looks like the beaver, but instead of having hair on its back it has scales, and in place of scales on its tail it has hair. This in itself would not constitute a missing link, but after long investigation we find, says Doctor Ward, that it lays an egg like a bird, but suckles its young like a mammal. Its habits are like the beaver's, but it is an utterly heterodox creature, and entirely the most unnatural known.

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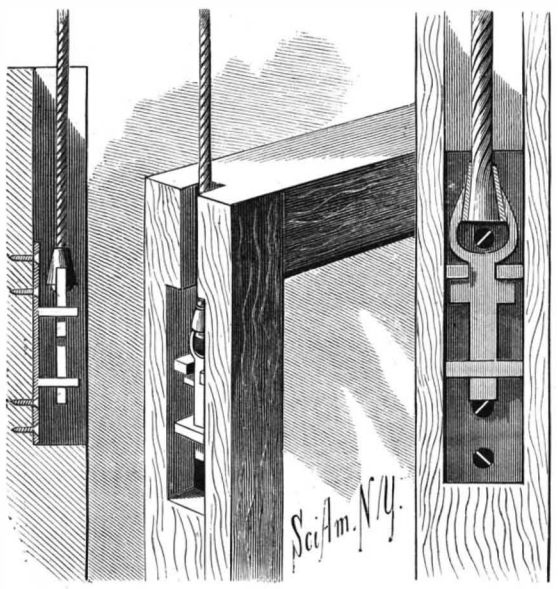
SASH CORD FASTENER.

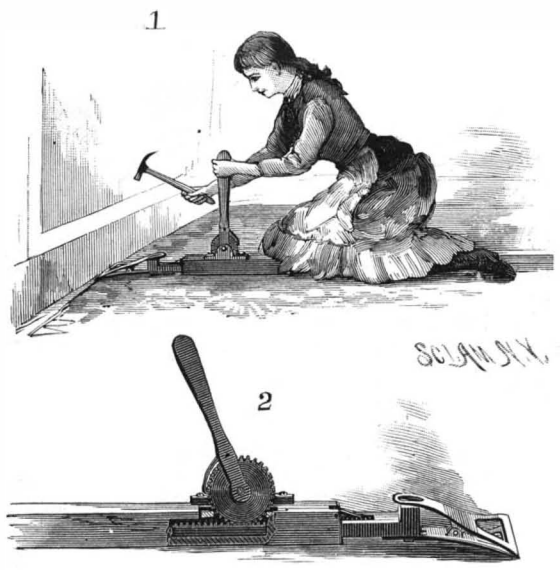
The accompanying engraving shows a sash cord fastener recently invented by Mr. Wellington H. Christ, of Pine Grove, Pa. On a plate secured by screws in a recess made in the sash bar a short distance from the upper end are formed two flanges, the lower one of which has an aperture to receive the lower end of the shank of the cord holder, whose upper portion enters an edge slot in the upper flange. The cord holder has opposite side arms which engage the upper flange for supporting the sash by weights. The sash cords are attached to cord holders by being passed into the upwardly tapering hollow thimbles of the holders, which connect by arms with the shanks of the holders so that a space is provided between the thimbles and shanks to allow the ends of the cords to be drawn downward for taking up the slack at any time. The ends of the cords are knotted or frayed and tied with twine to prevent them from being pulled through the thimbles. When the stop head of the window frame is removed, the cord holders may be readily taken out, and as they are too large to run through the sash pulleys, they form stops which prevent the cords from passing into the weight boxes. The plates and cord holders at each side of the sash may be connected and disconnected by any ordinary person without using tools of any kind, and the connection of the cords with the sashes when the cord holders are set in the plates is in every way secure.



CHRIST'S SASH CORD FASTENER.

CARPET STRETCHER.

By means of the simple and inexpensive device herewith illustrated, one person can easily stretch a carpet of any size. A rack sliding in a box engages with a cog wheel mounted on a shaft carrying a lever provided with a hook pawl engaging with the teeth of the wheel. On the outer end of the rack a plate is held by a screw passing through a longitudinal slot. Pivoted on this plate is a top clamping plate, the rear end of which rests above a head formed on the end of the rack. Pivoted on the end of the box is a pawl, which locks and holds the rack in place after the carpet has been stretched. The construction of the stretcher is clearly shown in Fig. 2.



DU SOUCHET'S CARPET STRETCHER.

Extending from the rear end of the box to the opposite wall is a brace made of two pieces of wood, of any desired length, either end of which will fit in the box. These pieces are so held together at each end by bands that they will slide past each other, and may be stopped at any place by means of a thumbscrew in one of the bands. The rod is fastened in the end of the box with a pin through the box and rod. By means of this extension bar the stretcher may be braced agains tthe opposite wall, no matter what the dimensions of the room may be. The edge of the carpet is held between the clamping plates, and is stretched by the outward movement of the rack, which is effected through the lever and pawl acting on the cog wheel. As the carpet offers some resistance, the bottom clamping plate will be moved slightly in the opposite direction until the end of the slot strikes the screw. This movement presses the head on the end of the rack against the under side of the inner end of the top plate, the outer end of which is pressed closely against the carpet, which is thus held securely. This carpet stretcher was designed by Mr. O. C. Du Souchet, of Warsaw, Ill.

Waste Heat from Furnace Chimneys.

The *American Engineer* says that one of the favorite schemes of inventors is to utilize the waste heat from boiler furnace chimneys before it leaves the chimney. Inasmuch as the heat of the gases must at least equal the temperature of the steam in the boiler, the editor concludes that only to be waste heat which corresponds to the excess of the temperature of the gases above that of the steam. In boilers properly set, with proper chimney and flue proportions, and working with economy, this excess of temperature is probably measured by 50° Fahr. Since the efficiency of good boilers equals almost 70 per cent, and this implies, besides other losses, the escape of gases at say 400° Fahr., it becomes at once apparent that a reduction of this temperature to say 350° Fahr., for instance, by abstracting the 50° Fahr. for heating exhaust steam, cannot signify a very great saving.

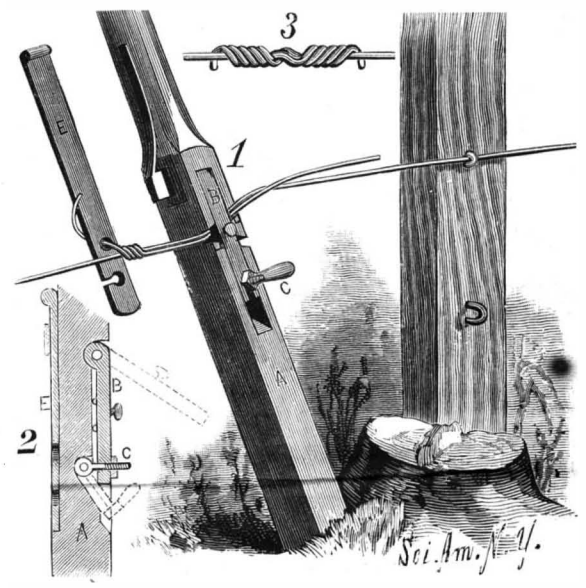
Still, it is the most common thing to hear of the placing of devices, such as coils of pipes through which exhaust steam travels, over the top of the boiler to utilize these 50° of heat, and marvelous economy is claimed as the result. Considering the fact that many boiler manufacturers have begun to doubt the efficiency of the return of the gases (of reduced temperature after passing through the tubes) over the top of the boiler, it is scarcely probable that there is much economy in not only doing this, but allowing in addition sufficient space for the refrigerating coils of pipe. The latter, it is true, may abstract some heat from the gases, but since they obstruct and cause frictional eddies, their employment necessitates not only larger flue but also greater chimney area. On the whole, it is exceedingly doubtful if the use of coils for heating exhaust steam in this way contributes to true economy and is good practice when the chimney is properly proportioned. Of course where the gases pass off at much higher than normal temperature, and the chimneys have been built larger than necessary or desirable, such expedients may contribute to economical working, though as a rule correction of the blunder proves the most effective remedy. A similar plan of extending the rear end of the boiler of locomotives to accommodate coils containing feed water has been proposed recently, but the obstruction proved so great as to make the attainment of proper draughts very doubtful. A further objection to this class of devices is that in a short time the carbonaceous deposits on the coils make the heaters themselves as such ineffective.

CABLE RAILWAY GRIP.

Passing through lugs upon the adjoining faces of the two jaws of the grip, and through the enlarged lower end of a heavy vertically arranged bar, is a strong pivot upon which both jaws are free to swing while held securely to the bar. At the lower end of the inner faces both jaws are provided with series of rollers (Fig. 3), which are journaled by eccentrically placed end pins in suitable bearings, so as to range vertically and at right angles with the pivot pin. At the lower end of the bar is a roller, which holds the cable down in place between the opposite grip rollers, should the cable tend to rise. Sliding upon the bar is a wedge connected by rods at each side with a head frame, also sliding on the bar. The upper ends of the side rods are threaded to receive bolts above and below the frame, so that the wedge may be adjusted vertically with relation to the gripping jaws and the lever, as may be required. The end of the lever is connected with the bar, and a link connects the lever with the frame, so that as the lever is moved the wedge is correspondingly moved to close the jaws, and cause the opposite rollers to grip the cable and allow the jaws to open to release the cable. A downward movement of the lever and wedge forces the opposite rollers toward each other to grip the cable; as the wedge is lifted, springs force the jaws apart. One of the upper corners of the bar is prolonged and slotted for the entrance of the lever to lock it sidewise for greater security when lowered. The grip is held in any suitable manner to the frame of the car. It is evident that as the opposite rollers are tightened upon the moving cable by the action of the wedge, they will be turned by the cable on their eccentrically placed pivots, and so have a cam-like action on the cable to tighten on it gradually and without violent shocks. Further particulars regarding this grip may be obtained from the inventor, Mr. John H. Parkinson, of Bodie, Cal.

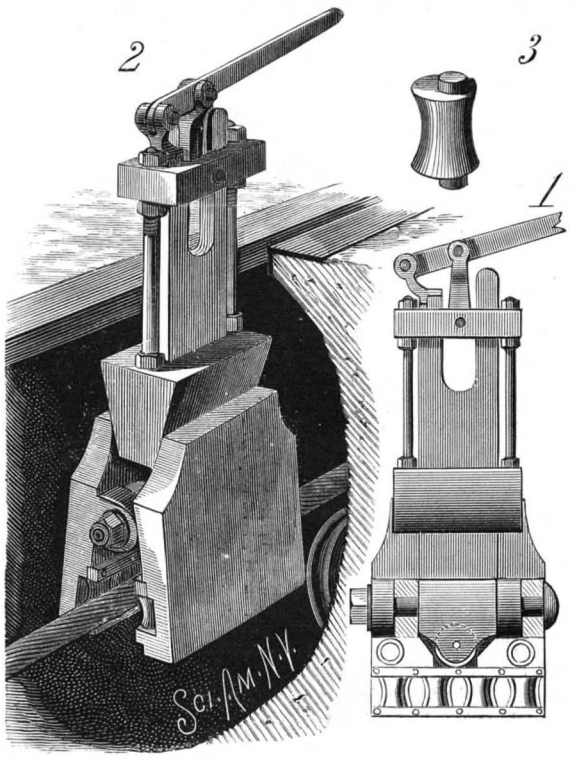
WIRE FENCE TOOL.

The simple, efficient, and inexpensive tool herewith illustrated is for use in stretching wires along the posts in setting up wire fences. The front side of the stock, A, has formed in it a recess, at one end of which is pivoted a vise jaw, B, which is slotted at its other end for the passage of the screw pin, C. The stock is slotted to allow the screw pin to swing back clear of the end of the jaw, to allow the latter to be opened to permit the wire to be passed between the jaw and stock. On the screw pin is a handle nut by which the jaw is brought down tightly to hold the fence wire. About beneath the center of the jaw a ⊲-shaped groove is cut in the face of the stock, so that when the wire is to be drawn, as in Fig. 1, it will be passed into the upper half of the groove, so as to draw over the corner of this part; when the wire is to be stretched the other way, it is passed into the lower half of the groove, to draw over the lower corner at the opposite edge of the stock. To protect the tool and insure a good hold, these corners are provided with wear plates. With these reversely inclined grooves there is no danger of the wire slipping, and when one of the wires of the fence has been stretched, the next wire can be stretched in the opposite direction, thus permitting the work to be carried on from both directions, thereby saving time and preventing the loosening of the posts by the pull of the wires when all are drawn in one direction.



BARRON'S WIRE FENCE TOOL.

The cutter, D, attached to the stock, normally springs out from the side sufficiently to admit the wire between its edge and a suitable plate let into the stock, so that a blow of a hammer on the cutter head will cut off the wire. The splicing bar, E, is held in a socket of the stock as shown in Fig. 2. When in use, one end of the wires is passed through the hole, and the bar placed against the wire (Fig. 1), and turned to coil the end, the wires being held meanwhile by the vise jaw. When that coil is finished, the end of the wire around which it is made is twisted around the other wire to form the completed splice, Fig. 3, the wires being shifted in the vise and the bar worked at the other side of the stock while making the second coil. The hole having a side opening is used with barbed wires.



PARKINSON'S CABLE RAILWAY GRIP.

This invention has been patented by Mr. J. B. Barron, P. O. box 131, Topsham, Maine.

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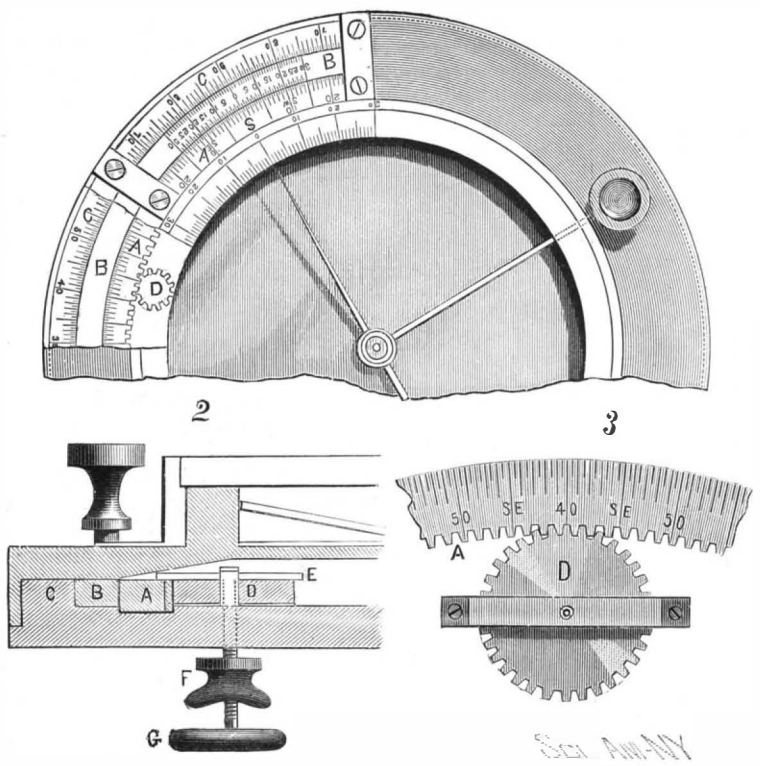
COURSE READING ATTACHMENTS FOR TRANSITS.

This improvement is probably the most important one made in surveying instruments since the invention of the transit, some fifty years ago. The great source of error, in producing meander or preliminary lines with either a transit or a compass, has always been in the necessity of calculating the course of each line, by either adding or subtracting the deflection angle to or from the preceding course. Especially are these calculations liable to error when the addition or subtraction of the deflection angle will put the course of the new line into another quadrant from the one in which the preceding course was located. Every engineer of any experience knows the great loss of valuable time and the annoyance often caused by errors of transit men in calculating courses.



NIXON'S COURSE READING ATTACHMENT FOR TRANSITS.

The inventor of this improvement, Mr. T. L. Nixon, of Tacoma, Washington Territory, has had extensive experience in transit work, and after some study contrived this simple but valuable improvement. Any one can understand the working of the instrument by a glance at the illustrations. The course ring, A, can be revolved upon the lower plate, or can be clamped to it at any desired point. This ring is divided into the different quadrants, and graduated so as to read by the vernier exactly the same as the vernier reads upon the outer circle, which circle is graduated from 0 up to 180°, just the same as the old style of instrument. Therefore, instead of deflecting an angle upon the outer graduated circle each time and making the calculation of the course, with this instrument the zero of the vernier is set at the course of the back sight, and then when the upper plate is unclamped and the telescope directed to the forward tack and the upper plate again clamped, by a look at the vernier and course ring the new course is read at once correctly, down to the finest graduation of the instrument, no matter whether it is known which way the deflection was made or not.

The revolving movements of the ring, A, are accomplished by means of the pinion, D, which is rigidly mounted on a spindle extending through the lower plate, and provided at its lower end with a thumb wheel, G, by which it may be readily turned. The ring, A, may be clamped in any position by turning the jam nut, F, so that it will bear against the plate. The vernier, B, is attached to the upper plate, and is fitted to travel immediately outside of the ring, A, and inside of a graduated circle, C, of the lower plate. The vernier is graduated to read minutes or half minutes, as desired, and the graduation extends to both edges, so that it will read precisely the same angle upon either the course ring or the circle, C.

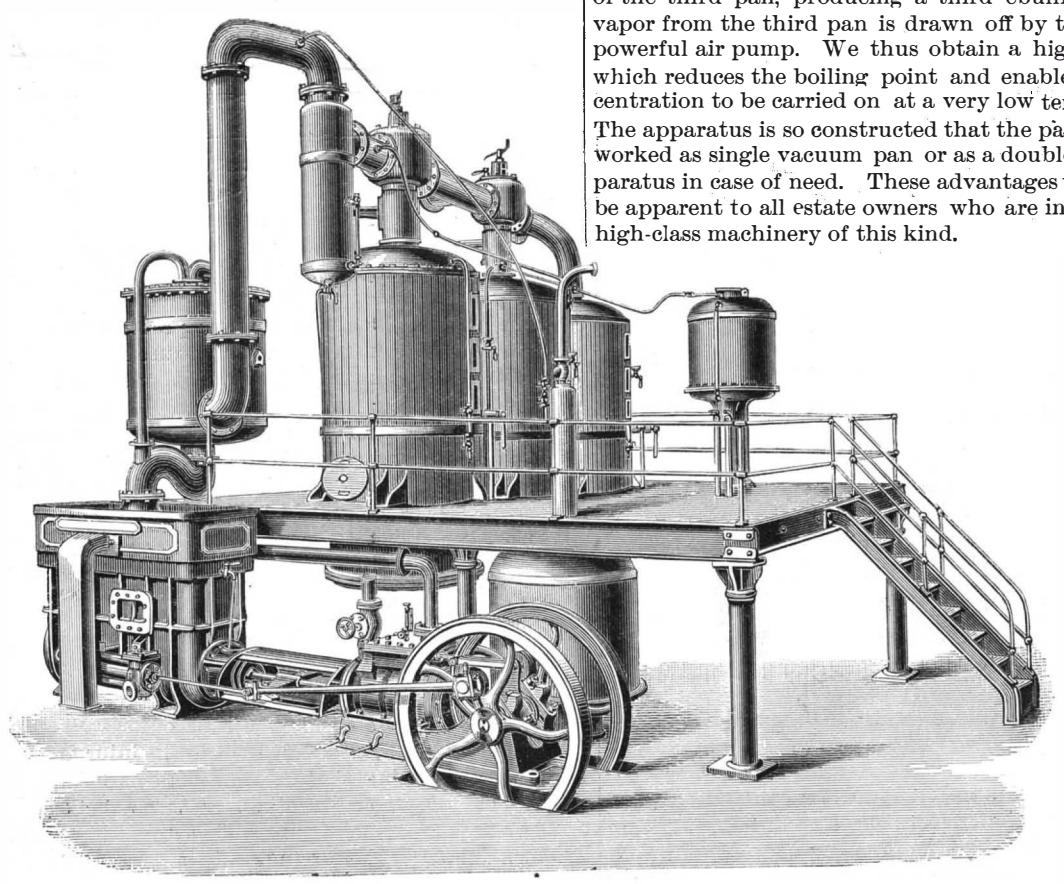
The New Orleans Exposition.

The attendance at this great show, although still far below what its projectors, and probably most of the exhibitors, had anticipated, has been materially greater for a month or so past than it was previously. But now the warm weather is coming on, always so trying in New Orleans, and the date set for the closing of the exhibition is near at hand. The managers, however, have been making an effort to have the exhibition reopened next fall. With this view they have determined to solicit the government to allow the national exhibits to remain, and to station a detachment of United States soldiers in charge of the buildings and grounds during the summer, trusting in this way to keep the most of the other exhibitors, and make the expense of continuance merely nominal.

TRIPLE EFFECT APPARATUS.

The accompanying engraving, prepared from a photograph, represents a triple effect apparatus, designed in the latest and most approved manner—the result of a long experience. The apparatus is shown connected to a patent air pump with condenser. It was manufactured by the Haslam Foundry Engineering Co. (Limited), Derby, and is of a type of which several have been made by that firm for sugar estates in Java and elsewhere. The commercial results have, in all cases, been most satisfactory to the purchaser.

The advantages of the triple effect apparatus are now generally admitted to be of the highest importance on all large sugar estates where economy of fuel is of great consideration. The mode of working the apparatus is as follows: Exhaust steam, collected from various engines working in the factory, enters the heating space of the first pan. The steam boils the cane juice; the vapor from the juice passes to the heating space of the second pan, producing a second ebullition; the vapor from the cane juice in the second pan passes to the heating space of the third pan, producing a third ebullition. The vapor from the third pan is drawn off by the aid of a powerful air pump. We thus obtain a high vacuum, which reduces the boiling point and enables the concentration to be carried on at a very low temperature. The apparatus is so constructed that the pans may be worked as single vacuum pan or as a double effect apparatus in case of need. These advantages will at once be apparent to all estate owners who are interested in high-class machinery of this kind.

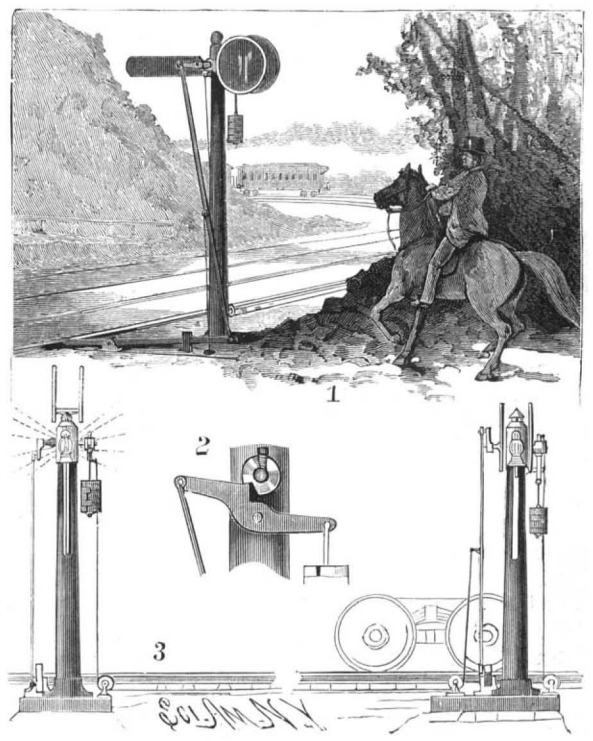


TRIPLE EFFECT APPARATUS.

RAILROAD SIGNALING APPARATUS.

Along the side of the track and at suitable distances apart are set posts (Fig. 3), at the forward sides of which are the outer ends of levers, pivoted at a little distance from their inner ends to supports attached to the ends of the ties. The levers are at right angles with the track, and with their inner ends so near the rails as to be struck by the treads of the wheels of passing engines, and pressed downward, raising their outer ends. The outer ends of the levers are connected by rods with the outer ends of crank arms, attached to the ends of short shafts in bearings in the upper ends of the posts. To the shafts are attached signal arms, which, when displayed, project horizontally toward the track, and when withdrawn hang vertically. To the shafts, and projecting in opposite directions from the signal arms, are attached pairs of arms carrying colored glass plates which, when swung down, rest at each side of lamps. To the shafts are also attached single tooth ratchet wheels (Fig. 2), the teeth of which, when the signals are displayed, engage with teeth formed upon lever pawls pivoted to the posts, and which hold the signals securely in place when displayed. The pawls are held against the wheels by weights suspended from their rear ends, and which are of such weight as to only slightly overbalance the forward ends of the pawls. These ends of the pawls are secured to the ends of ropes passed around a pulley near the base of one post, and then around a pulley on the next forward post, and their other end fastened to the connecting rod of the forward post.

As the engine reaches each post it operates the lever and displays the danger signal on that post, and at the same time trips the lever pawl on the next preceding post, and allows the signal on that post to drop out of sight. Above the outer parts of the levers are placed springs, which prevent those parts from being raised too high, and also prevent too great a jar when the outer parts are struck by the wheels. This invention has been patented by Mr. Emil Baumbach, of 241 Broadway, New York city.



BAUMBACH'S RAILROAD SIGNALING APPARATUS.

Perfumes of the Orange.

From the orange, *Citrus aurantium* and *C. bigaradia*, are obtained five distinct and valuable perfumes: 1. The true orange flower essence, obtained by digesting the flowers with lard. 2. *Oil neroli petale*, or *oil neroli bigarade*, by distilling the flowers of the sweet and bitter orange respectively. 3. *Oil neroli petit grain*, obtained by distilling the leaves and unripe fruit. 4. *Oil orange of Portugal*, obtained by rolling the fruit in a metal cup covered with spikes on its inner surface (known as *ecuelle*), which wounds the rind, and causes the essence to flow from the oil glands. 5. Commercial *oil of orange*, obtained by expressing or distilling orange peel.

Paper Slippers.

Paper slippers are the latest form in which paper is introduced in new inventions. An Englishman has patented a system of manufacturing slippers, sandals, and other coverings for the feet out of paper. Paper pulp, or papier mache, is employed for the upper, which is moulded to the desired form and size, and a sole is provided made of paper or pasteboard, leather board, or other suitable paper material, which is united to the upper by means of cement, glue, or other adhesive material. The upper is creased, embossed, or perforated at the instep and sides, which renders them somewhat pliable, and prevents their cracking while in use.

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A Sunken Continent in the Pacific.

The fact is quite generally conceded among scientists that the probabilities are strongly in favor of the supposition that there formerly existed a large island, of continental dimensions, between the West Indies and the western coast of Africa. This continent is supposed to be the "Atlantis" of the ancients, whose recent discoveries point to the further probability that there also once existed a similar continental area of land in the Pacific Ocean, between the west coast of South America and the present Australian continent, as it is sometimes called.

At a recent meeting of the Academy of Sciences of San Francisco, Captain Churchill read a very interesting paper in relation to this matter. His paper referred especially to the gigantic sculptured figures still to be seen upon Easter Island, and evidently the work of a different race than that which now inhabits the island, and one much more numerous, since the works referred to are on too large a scale to have been constructed except by many hands. He argued that a vast continent once existed where there is now nothing but a waste of ocean, dotted with countless isles and islets of varying size and character, the majority showing in their formation the traces of that former volcanic action which either upheaved them from the depths of the sea or shattered and sunk the continent of which they are now the only vestige. Easter Island, it is believed, was once the home of a population numbering many thousands, of whom scarcely any now remain. Besides dwelling upon the sculptured figures to be found there, Captain Churchill laid much stress upon the hieroglyphic tablets of wood discovered upon Easter Island, and which are the only instance of a written language in Oceanica. He thought sufficient attention had not been given them.

From other sources we learn that a German government vessel recently visited that island, and made a large collection of prehistoric remains, and made copious notes of other matters of scientific interest. The German government, it is understood, are making preparations to send another expedition to Easter Island with a corps of scientists and engineers to sketch the island, surveying the ground, and to make plans and sections of the prehistoric buildings and ruins.

Our own government has also taken steps to secure some of these valuable remains representing the prehistoric and known races of this hemisphere. Instructions have already been sent to Admiral Upshur, in command of the South Pacific squadron, to send one of his vessels on a cruise in the direction of Easter Island, and to make such explorations, collections, and reports as he may think important in the interests of his government. The Government of France is also turning its attention to this island, with a view to the establishment of a protectorate.

It is reported in the accounts given by the German vessel that the island, which is small, is strewn with large stone images and sculptured tablets. The inhabitants of the island know nothing about the remains, and even tradition gives no account of a people living there when their ancestors arrived.—*The Jewelers' Journal.*

Launch of the Mersey.

The first of a new class of British "protected corvettes" intended to act as swift cruisers, was recently successfully launched from the Royal Dockyard at Chatham.

Designed as an armed cruiser for service in which her usefulness and her own safety upon occasion will depend upon her speed and ability to maneuver rapidly, the Mersey is fitted rather for attack than defense. Although she might not be able to do much mischief to a fort or a first-class ironclad, her armament, including two 8 in. and ten 6 in. breechloading guns, torpedoes, and ram, would make her a formidable opponent for any unarmored ship. The guns will be disposed so as to give the power of firing with the greatest possible effect while maneuvering. The two large guns are to be pivoted, one on the forecastle and one on the poop. On either side, fore and aft of amidships, are two projections or sponsons, and in each of these one of the 6 in. guns is to be placed, the others, three on a side, between the sponsons, increasing the effectiveness of her broadside fire. Long ports in the forward sponsons permit the guns to be trained 4° across the bow and to an angle of 60° abaft, giving a lateral range of 154°, while they may also be fired with a depression of 7° or at an elevation of 20°. The after sponsons admit of an equal range of fire. These guns carry their own shields for the protection of the gunners. She is also to carry one 9 pounder and one 7 pounder boat and field gun, a 1 in. Nordenfelt, and two 0·45 in. Gardner guns. Whitehead torpedoes will be carried, and provision is made for discharging them either above or below water on each broadside. Except for the steel faced armor, 9 in. thick, protecting the conning tower, and the steel protective deck plating, 2 in. thick where it is horizontal and 3 in. thick where it slopes downward across the coal compartments at the sides, the Mersey is unarmored. The authorized complement of coal is 500 tons. Her engines, of the horizontal compound pattern, are to be of 6,000 indicated horse power. She is provided with twin screw propellers, and it is anticipated that her speed will be 18 to 19 knots an hour. The principal dimensions of the ship are: Length between perpendiculars, 300 ft.; extreme breadth, 46 ft.; mean draught of water, 17 ft. 9 in.; load draught amidships, 19 ft.; load displacement, 3,600 tons. Her crew will number 300 officers and men.

THE CYCLOSTYLE.

The cyclostyle is one of the latest of the several processes which have been invented for reproducing manuscripts and drawings. In it, the stencil has met with

These few words are a facsimile of work produced by this process.

a new application, and one which produces excellent results. The apparatus consists in a plain walnut board provided with a zinc writing tablet. A double frame, also of walnut, fits snugly around the zinc, having its under frame hinged to the board at one

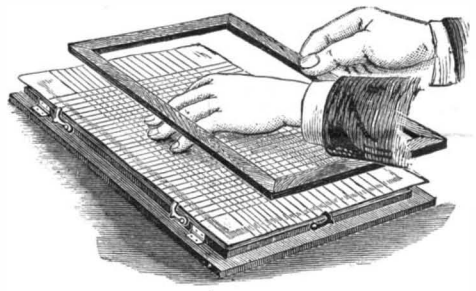

Fig. 1.

side. The upper frame being removed, a sheet of thin waxed paper is placed on the tablet, as indicated in Fig. 1. The frame is then replaced and locked to the underneath one, as shown in Fig. 2. In this manner the paper is securely fastened in the frame, the same

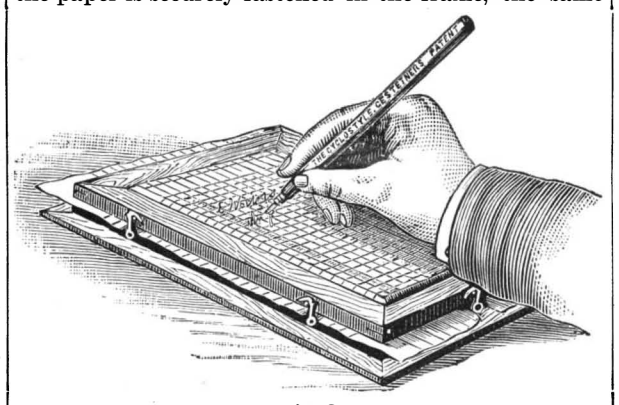

Fig. 2.

as in an ordinary drawing board, and the instrument is ready for use. The cyclostyle pen consists of a tiny wheel made of an alloy of iridium and palladium, and having sharp cutting edges on its circumference. This is pivoted to a steel bar attached to a wooden handle.

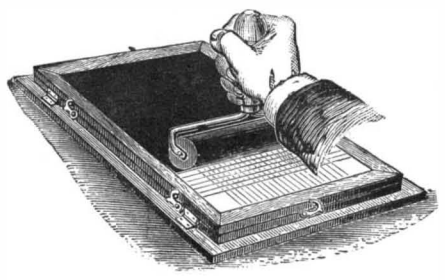

Fig. 3.

The pen is used just the same as the ordinary form, except that slightly great pressure is exerted. As it passes over the surface of the waxed paper, the little wheel revolves, turning in the direction of the writing, and leaves a series of minute perforations, so close to-

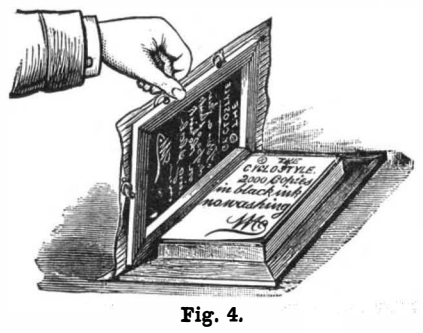

Fig. 4.

gether that the line traced appears continuous. When the writing is completed, a piece of ordinary writing paper, preferably unglazed, is placed under the waxed paper and on the zinc tablet. An inking roller is then passed over the waxed paper, as represented in Fig. 3. A quickly drying printer's ink is used. On lifting the frame, a clear and exact reproduction of the writing is found on the sheet underneath, as shown in Fig. 4. This copy has the decided advantage of being in black ink, and possessed therefore of all the appearance of a written letter. As many as two thousand copies can be obtained from the one writing, and at a rate of from four to five hundred an hour. The new process has met with a very favorable reception. It is already in use by several government departments and by many firms and corporations. At the office of the Cyclostyle Company, 152 Broadway, quite an interesting scrap book is on exhibition, illustrating a great variety of manuscripts and sketches reproduced by this process.

Native Mercury in Louisiana.

Native mercury has been recently discovered in a locality where its presence has hitherto been unsuspected. At "Cedar Grove" plantation, in Jefferson Parish, Louisiana, on the west bank of the Mississippi, ten miles above New Orleans, native mercury occurs in small globules disseminated through the alluvial soil. These globules vary in size from a microscopic pellet to a BB shot used for sporting purposes. They seem to be thoroughly admixed in the soil, and although more abundant within a limited area, are found for a distance of 1,200 feet. Beyond this distance, the limited time at my disposal did not allow me to investigate, but the appearance of the soil seems to indicate that the metal is gathered around a certain center, and gradually disappears as the distance from this center increases.

The apparent center lies about 300 feet from the Mississippi River in an orange orchard, where, also, a number of live oaks are in luxuriant growth. The presence of this mercury has been noticed for a number of years, during the operations of plowing and ditching, but has never, to the writer's knowledge, been officially reported to the scientific world.

The writer took two negro men, with spades, to the locality, and obtained several specimens of the soil, one to five feet below the surface. He also washed out on the spot, from a small wash tub full of earth, about two or three ounces of the native element. An analysis of two triturated specimens of the half dried earth was made with the following results:

1. Weight of soil,	500 grms.	Wt. Hg,	1·4652 grms.		p. c. 0·0029+
2. "	" 500 "	"	1·4687 "		0·0029+
Total,	1 kilo.	Total,	2·9339	" mean, p. c.	0·002934

Giving a mean percentage of mercury of 0·002934 per cent. The soil is all alluvial, and for a depth of 25 feet is as follows:

1. Surface, mercury bearing stratum, six feet thick. A sandy soil containing blue clay and a vegetable mould.
2. Stratum of blue clay 6½ feet thick.
3. Similar stratum to surface, but containing no mercury, six feet thick.
4. Stratum of blue clay 6½+ feet thick.

It is not known how much deeper the fourth stratum extends. In none but the upper stratum of alluvial soil does mercury occur in sufficient quantity to be perceptible to the naked eye.

The large quantity of mercury, the great area over which it is scattered, the situation *above* the most frequented resort of commerce, the protection from overflowing by levees, and the absence of any appearance or history of any large cargo of mercury being wrecked in that vicinity, make it extremely improbable that such results could have been effected by the agency of man.—*E. Wilkinson, American Journal of Science.*

French and English Timber Flooring.

We can and do frame floors most effectively by carpentry alone, whereas the French do the work in framing their floors so badly that no important bearing is, or indeed may be, trusted by them to the framed joint, dog-nailed stirrup straps of iron being always brought in aid. But the common practice with us, who can and do frame floors well, is to use single or unframed floors, which carry the weight and the vibration to which floors are exposed into the walls over voids as well as over solids; while, on the other hand, the French almost invariably frame their floors to or upon girders, by means of which the floors are brought to bear upon the solids of the walls. The walls are thus not only less exposed to vibratory action, but are both tied together and strutted apart with better effect by the stout girders stiffened by joists than by joists which themselves require some foreign aid to stiffen them. Moreover, single floors of joists, unless trimmed at frequent intervals—when, indeed, they may be termed half-framed—require, or are thought to require, plates of timber laid along the inside faces of outer walls and upon internal walls, and thus tend to the injury of the walls by introducing timber, that bane of brick and stone walls, into their structure, so as to render the timber a part of the structure. This defect is avoided by our neighbors, who exclude all timber, except the bearing ends of girders, from their walls, and who use framed floors.—*Professor Hosking.*

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Explosions from Non-explosive Liquids.

In a lecture before the Royal Institute (London), on the 13th of March, by Sir Frederick Abel, C.B., after giving an account of a large number of explosions on shipboard and elsewhere resulting from the escape of the vapors of inflammable non-explosive liquids, the lecturer proceeded to state the cause of many accidents, and suggested the remedies for them, which are substantially as follows:

If a partially filled lamp were carried or rapidly moved, a mixture of oil vapor and air might be caused to escape from the lamp in close proximity to the flame, and becoming ignited might produce the explosion of the mixture in the reservoir. This escape might occur through the burner itself if the wick did not fit the holder properly, or through openings which exist in some lamps in the metal work close to the burner, of sufficient size to allow flame to pass through them readily. A sudden cooling of the lamp by its exposure to a draught or by its being blown upon, as, for instance, in adopting the common practice of blowing down the chimney to extinguish the flame, might give rise to an inrush of air, and the flame might be at the same time drawn or forced into the reservoir. If the quantity of oil in the reservoir were but small, and the air space large, an explosion would obviously exert greater violence than if these conditions were reversed. If the wick were lowered very much, or if for some other reason the flame were burning very low, the lamp would be liable to become much heated, and the tendency to the production of an explosion would be increased. Oils of high flashing point were more liable to cause heating of the lamp in consequence of the higher temperature developed by the combustion and the comparative slowness with which a heavy oil was conveyed by the wick to the flame. It therefore followed that safety in the use of mineral oil lamps was not to be secured simply by the employment of oils of very high flashing point (or low volatility), and that the use of very heavy oils might even give rise to dangers which were small, if not entirely absent, with oils of comparatively low flashing point. The character of the wick very materially affected not only the burning quality of the lamp, but also its safety. A loosely plaited wick of long staple cotton would draw up the oil to the flame regularly and freely, while, if the wick were very tightly plaited and made of short staple cotton, it would be of inferior capillary power, the oil would be less copiously drawn up, and undue charring of the wick—with considerable heating of the lamp—might ensue. If the wick were damp when taken into use, or if the oil contained moisture, the capillary action of the wick would be impaired; and long continued use of the wick would be liable to result in its becoming choked with impurities, held in suspension in the oil strained through it. Many lamps were so designed as to facilitate the production of explosion, openings or channels being provided through which the flame might pass into the oil reservoir.

Five simple suggestions the lecturer made for lessening the risk of accident which attends the use of petroleum and paraffine oil:

1. The reservoir of the lamp should be of metal, and should have no opening or feeding place in the metal.
2. The wick used should be soft and loosely plaited; it should fill the wick holder, but not so as to be compressed within the latter, and it should always be thoroughly dried before the fire when required for use. The fresh wick should be but little longer than is required to reach to the bottom of the reservoir, and should never be immersed to a less depth than about one-third the total depth of the reservoir.
3. The reservoir of the lamp should always be almost filled before use.
4. If it is desired to lower the flame of the lamp for a time, this should be carefully done, so as not to lower it beneath the metal work more than is absolutely necessary.
5. When the lamp is to be extinguished, and is not provided with an extinguishing apparatus, the flame should be lowered until there is only a flicker; the mouth should then be brought to a level with the top of the chimney, and a sharp puff of breath should be projected across the opening.

Expenses of Business.

A well informed merchant of Boston recently said to a representative of a Boston newspaper that he had been looking back over his accounts, and was surprised to find that since the close of the war there had been a steady increase in the ordinary expenses of carrying on business. That this increase of business expenses extends beyond the merchant to the manufacturer and most other kinds of business is a fact patent to most employers. Mere office work costs a great deal more now than it did in 1865; more clerks are needed, and, on the whole, each of these receive higher pay. Assistance is required in the receiving and delivering departments to an extent and of a character that would not have been dreamed of two decades ago. Then there are a variety of incidental expenses that now enter into the computation. There are telephone charges, printing, the expense of solicitors, the whole making up an amount sufficiently large to eat up all that would have been considered fair profits a quarter of a century ago. It is probable that the experience in different trades varies, and yet we fancy that in most lines of business statements somewhat similar to the above might be made. The tendency, all the time going on, to lessen the hours of service, both in offices and workshops, of itself makes the cost of business proportionately higher. Competition is sharper than it was ten or twenty years ago, and prices are so much reduced in most commodities which enter into the necessities of a household, that mechanics, clerks, and others are enabled to live much better now than it was possible for them to do ten or twenty years ago, when their wages were less and the cost of living was greater.

Remarkable Career of an Adventurer.

News comes from Lima, Peru, of the recent death there of Alfred Paraf, one of the most remarkable swindlers of the age. The story of his life reads more like an extravagant fiction than a sober reality, the truthfulness of which can be attested by many of our best known chemists and keenest business men. Born of a wealthy and highly respectable family of Alsace, and receiving a first-class education, he then took a course of chemistry, for which he seemed specially fond, and was placed in charge of the laboratory of his father's print works in Mulhaus. His inventions of new combinations and improvements on old processes in dyeing and color work showed high talent, but being short of money on a trip to Scotland, he used his abilities to impose upon a Glasgow firm a so-called new color for $20,000. The dye was new and cheap, but not durable, but while the money lasted he lived with great show, and then imposed upon a Paris firm in a similar way, from which he received sufficient to start him on a career in this country. He landed in New York in 1867, 22 years of age, and with his accomplishments and ready tongue, besides a lavish use of money, soon had a wide circle of acquaintances. He professed to have discovered an improved aniline black, with which he traveled through New England, selling licenses in manufacturing towns for two to three thousand dollars each, until he had some sixty thousand dollars, with which he returned to New York and lived for a brief period after his accustomed expensive style. The real owner and patentee of the dye in Europe coming over to enforce his own rights, Paraf had to discover "new colors," one of which, called "cloverine," nearly ended his career by an explosion which occurred in its preparation, but yielded him a good deal of money. The next speculation was on a new method of employing extract of madder, for which, it is said, ex-Gov. Sprague of Rhode Island paid Paraf $75,000, and then invested $300,000 in a plant to utilize the new method, all of which was lost. Paraf subsequently stole the oleomargarine process of Prof. Mege, and formed a stock company of half a million dollars for this new manufacture here, and afterward in San Francisco. It was now about time for the adventurer to disappear, which he did only to be again heard from in Chili, with a scheme for extracting gold from copper ore, and a big joint stock company. The fraud here was discovered in November, 1877, and Paraf but narrowly escaped lynching before he was convicted and sentenced to his first and last term of imprisonment, since which his name has been lost to the public until this announcement of his death calls to mind so many vivid recollections.

Contagiousness of Dry Rot.

The parish church of the Holy Trinity in Cork having been found to be in a bad state of repair, and quite deformed from bad and unequal foundations, the parishioners resolved on building a new church; but, through want of funds, not being able to carry their designs into execution, an extensive repair was decided on. The tower was taken down, and one side wall and the end of the church were rebuilt. Immediately under the floor of the church, and open to the burial vaults underneath, longitudinal beams of Irish oak, of from 12 to 14 inches square, had been placed, resting on piers, and forming supports for the joists. Though these oak beams were decayed for an inch deep at their surfaces, sufficient of the timber (as it was thought) remained sound, and it was decided that neither they nor the piers upon which they rested should be removed.

The vaults were arched over, memel joists, 6 inches by 4 inches, were placed on the vaulting, and connected with the old oak beams which rested on the piers; the floors were removed, the old pews replaced, new columns, coated with scagliola, were erected over the galleries, the old ones in the lower tier retained; and the whole repairs having been thus completed, the church was reopened for divine service in April, 1829. In November, 1830 (but eighteen months afterward), the congregation was annoyed by an unpleasant smell, which, on examination, was found to proceed from dry rot of the most alarming nature. On opening the floors under the pews, a most extraordinary appearance presented itself. There were flat fungi of immense size and thickness, some so large as almost to occupy a space equal to the size of a pew, and from 1 to 3 inches thick. In other places fungi appeared growing with the ordinary dry rot, some of an unusual shape, in form like a convolvulus, with stems of from ¼ to ½ an inch in diameter.

When first exposed, the whole was of a beautiful buff color, and emitted the usual smell of the dry rot fungus. Whatever may have been the surprise at the rapid growth of the plant, its action on the best memel timber was a source of greater astonishment. I took up, with nearly as much ease as I could a walking cane, that which, eighteen months before, was a sound piece of timber (one of the joists), from 12 to 14 feet long, 6 inches by 4 inches scantling; the form of the timber remained as it came from the saw, but its strength and weight were gone. The timber of the joists and floor over the new brick vaulting was completely affected by the dry rot, which was rapidly spreading to the lower part of the columns under the galleries, so that, at the rate the infection proceeded, the total destruction of the building would soon have been effected. During a great part of the time occupied in the repairs of the church, the weather was very rainy. The arches of the vaults having been turned before the roof was slated, the rain water saturated the partly decayed oak beams, before described. The flooring and joists, composed of fresh timber, were laid on the vaulting before it was dry, coming in contact at the same time with the old oak timber, which was abundantly supplied with the seeds of decay, stimulated by moisture, the bad atmosphere of an ill-contrived burial place, and afterward by heat from the stoves constantly in use. All these circumstances account satisfactorily to my mind for the extraordinary and rapid growth of the fungi.—*Sir Thomas Deane in The Architect.*

Habits of Crabs and Lobsters.

A few evenings since, Professor Bickmore delivered a very interesting lecture at the American Museum of Natural History on the habits of crabs and lobsters. The appendages of the lobster were remarked upon as peculiarly adapted to its natural wants. The two claws or pincers differ the one from the other, a fact which always gives them an ungainly appearance. One of the claws has a series of grinders, and is used as a mill to crush shell fish and other hard substances, while that on the opposite side is provided with a sharp edge, which is used for cutting. The lobster propels itself by means of thin plates attached to the body, which it uses as oars. Its eggs are attached to and carried about on the under side of the body, and to protect them from rocky bottoms the tail of the animal is doubled up under it, completely covering them.

The crab is a higher order of animal than the lobster, the Professor said, and he described a number of different classes of the species. The fiddler crab was so called from the peculiar shape and motion of its claw. It has a set of grinding teeth in the anterior portion of its stomach, and a grinding movement is kept up almost continuously. The eye of the crab was very peculiar, consisting of a series of tubes bound together, each tube representing a single eye. He sees singly by combining the images in his mind after the manner of a mosaic. The long feelers of the crab are designed for reaching into crevices of the rocks after its prey. The giant of all crabs is found in the bay of Yeddo. Its legs are 11 feet long, and it scarcely has body enough to hold them together. The hermit is a queer sort of animal, which takes up its habitation in shells vacated by other animals. If a hermit crab was placed in a tub of water with several shells, it would examine them all, and then select that best adapted to its comfort. If two or three crabs were put among the same shells, they would often fight for the best shell. The hermit often traveled about in conjunction with a polyp as a means of protection from the octopus. The polyp did the fighting, while the hermit carried him about and collected food for both.

A crab and a cocoanut were held up by the Professor before his audience. The crab, he said, was a palm crab, and lived in cocoanut groves. It tears off the husk with its claws, hammers through the shell, and then lifts out the meat in chunks with its pincers. The palm crab has a special breathing apparatus which enables it to breath out of water. The most peculiar of all the crabs was a certain species which lives in the mountains. The animals keep well out of the way during the daytime, but they are fond of making moonlight excursions in little groups to wet their gills in water. They not infrequently stop at vegetable gardens in their marches, and the damage they do makes the farmers their enemies. The barnacle was said to be of the same general species as the lobster and the crab.

Hardening Plaster.

The author mixes intimately 6 parts of plaster of good quality with one 1 part of fat lime, recently slaked and finely sifted, and uses this mixture like common plaster. He then moistens the object thus formed with a solution of zinc or iron sulphate.—*M. Julhe.*

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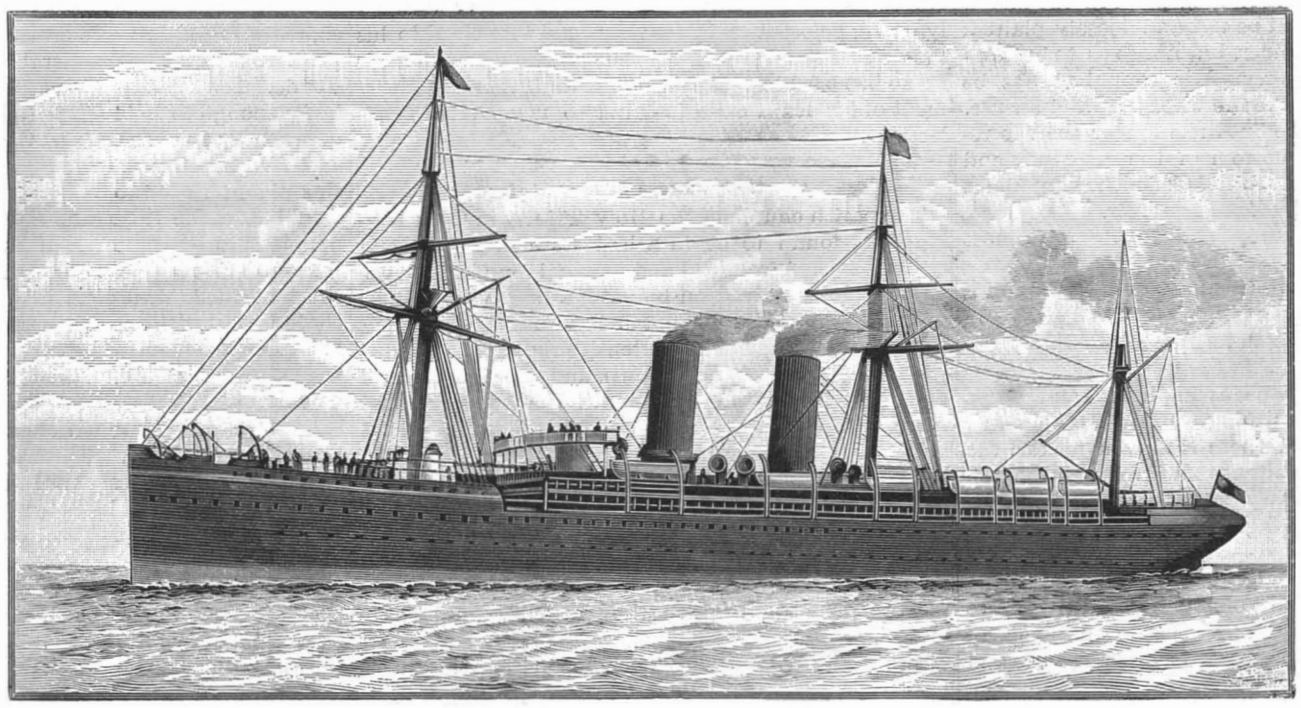
Coignet's Concrete.

M. Coignet has, says Captain Fowke, as the result of a series of experiments, given us the recipes for making two kinds of concrete suitable for house building, which he distinguishes by the epithets of economic concrete and hard and solid concrete. The first is composed of sand, gravel, and pebbles, 7 parts; argillaceous earth, 3 parts; quicklime, 1 part. This concrete, he says, properly beaten up and mixed, has given walls nearly as hard as the common soft rubble masonry used in Paris. In price it competes with ordinary pise work, over which, however, it has the advantage of being able to resist moisture. The hard concrete is composed of sand, gravel, and pebbles, 8 parts; common earth, burnt and powdered, 1 part; cinders, powdered, 1 part; unslaked hydraulic lime, 1½ parts. The materials to be perfectly beaten up together. Their mixture gives a concrete which sets almost immediately, and becomes in a few days extremely hard and solid, which property may be still further increased by the addition of a small quantity, say one part, of cement; and the price, depending principally on that of the time and labor, was in Paris, under favorable circumstances, 3½d. to 4d. per cubic foot; with more favorable conditions, 2d. per cubic foot. A house three stories in height, 65 feet by 45 feet, standing on a terrace, having a perpendicular retaining wall 200 feet in length and 20 feet high, has been actually constructed with every part, including foundations, vaults of cellars, retaining wall, all walls, exterior and interior, without exception, of this hard concrete (Beton dur), as well as the cornice, mouldings, string courses, balustrades, and parapets, and without bond iron, lintels, or wood throughout. The use of plaster in the interior is also avoided, as the concrete takes a surface sufficiently fine for papering.

THE NEW CUNARD STEAMSHIP ETRURIA.

In September, 1884, Messrs. John Elder & Co. launched from their yard at Govan the Etruria, a large steel screw steamer for the Cunard Company, to supplement their service of express steamers between Liverpool and New York. The dimensions of the vessel are: Length over all, 520 ft.; breadth, extreme, 57 ft. 3 in.; depth to upper deck, 41 ft., and to promenade deck, 49 ft.; with a gross tonnage of about 8,000 tons. She is entirely built of steel throughout, and is divided into 10 water tight compartments, most of the bulkheads being carried up to the upper deck, and fitted with waterproof and fireproof doors, giving access from one part of the ship to the other. By this arrangement the danger of fire spreading, should it break out in any division of the ship, is removed as far as possible, and greater safety is obtained by being able to isolate any apartment for sanitary purposes, or in case of damage to the hull and the compartment being flooded.

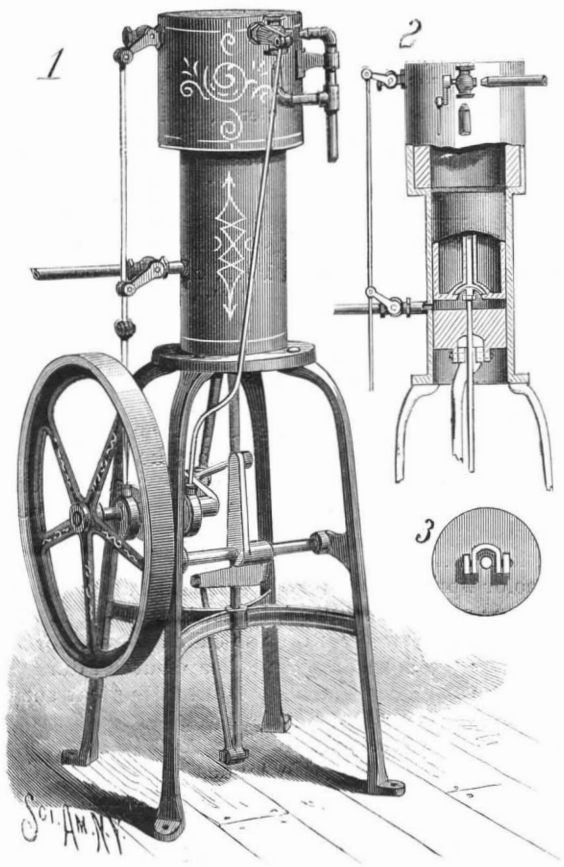
The special care taken in providing for the safety of the ship and the lives on board entitles her to rank as a transport of the highest class, and she is entered on the Admiralty list, being specially constructed for the requirements of the "service" for mercantile auxiliaries in the time of war. She has five decks in all, including the promenade deck, which extends over the breadth of the vessel for nearly 300 ft. amidships, and would be reserved for the use of first-class passengers. The first-class accommodation forms a special feature, and occupies the whole of the main and lower decks, with the exception of the portion set apart for the use of the crew. Altogether, accommodation can be provided for 720 first-class passengers, the largest part of which is arranged for two-berth staterooms only, which are replete with all fittings usual in the highest class of passenger steamers—a number of the rooms being fitted *en suite* for family use. The engines are made to indicate upward of 14,000 horse power. They are compound, having three inverted cylinders—one high pressure 71 in. in diameter, and two low pressure each 105 in. in diameter. The high pressure cylinder is placed between the two low pressure cylinders, and all are adapted to a stroke of 6 ft. The Etruria reached New York from Liverpool, on her first voyage, on May 4, 1885; on one day during the trip she ran 449 miles. On her trial trip she made 24 miles an hour. Our engraving is from the *Illustrated London News.*



THE NEW CUNARD STEAMER ETRURIA.

AN IMPROVED GAS ENGINE.

It is claimed that the gas engine herewith shown saves a great part of the heat which, in the engine of ordinary construction, is taken up by the water in the jacket. It gives power at every stroke, and is thus more efficient than those giving power only at alternate strokes. The engine cylinder is made with an



McDONOUGH'S IMPROVED GAS ENGINE.

open lower end attached to a supporting frame, and is prolonged upward for a distance equal to about two diameters. The upper part is made larger than the lower, so as to form a space for a fire brick lining, shown in the sectional view, Fig. 2. The upper part constitutes the combustion chamber, and by this construction the engine is less expensive to manufacture than if the parts were made separately and bolted together. In the lower part of the main cylinder is an inlet port to admit gas, and in the upper part of the combustion chamber is an exhaust port. The stems of both the valves are connected with the same rod, actuated by an eccentric on the driving shaft, so that both valves will be operated at the same time. The shaft revolves in bearings in the frame, and is provided with a balance wheel to give steadiness of motion to the moving parts.

Near the upper end of the combustion chamber is a port through which ignition of gas takes place, the ignition being controlled by a valve provided with an ignition gas jet and a relighting jet. This valve is operated by an eccentric on the driving shaft, so that it will be opened and closed at each revolution. In the cylinders are two pistons, the upper one being made long, and formed with a central longitudinal perforation, in the lower end of which is a valve opening upward to allow the gas to pass freely upward and prevent its return. The lower end of the piston rod of the long piston is connected with the long arm of an elbow lever operated through a rod connecting its other arm with the crank of the driving shaft. To the shaft is also pivoted the piston rod of the lower piston.

The operation of the engine may be easily understood: When the long piston begins to move away from the other, the gas enters the space between them, and at the same time the spent gas from the previous ignition is driven out through the exhaust port. Then the pistons move toward each other, when the gas, being compressed, opens the valve and passes through the perforation in the long cylinder into the combustion chamber. When the short piston is at the end of its inward stroke, and the long piston is nearly in contact with it, the gas is ignited, and expands, forcing the pistons outward and completing the cycle of movements. By this arrangement the gas is introduced into a cold cylinder, compressed, and then transferred to a hot chamber, where it is fired, expanded, and exhausted at each revolution of the shaft.

This invention has been patented by Mr. Thomas McDonough, of Montclair, N. J.

Separation of Oxygen by Means of Silver.

Troost has recently demonstrated that metallic silver allows oxygen gas to pass through it at a red heat, in a manner similar to the passage of hydrogen through red hot platinum or iron, which was proved some years ago by Deville and Troost. For the experiments a tube of silver was used with a diameter of 1 cm., the thickness of the metal being 1 mm. This was inclosed in a rather larger tube of platinum. When the tubes were heated, and oxygen gas was drawn through the space between the tubes, it was found to pass into the silver tube. The amount passed corresponded to 1·7 liters per hour for every square meter of silver surface. If air were passed between the tubes instead of oxygen, then it was found that practically only oxygen found its way through into the silver tube, as only traces of nitrogen accompanied it. The rate of passage was, however, very much diminished. These experiments were carried on by exhausting the silver tube by means of a Sprengel pump, but it was also found that it was not necessary to thus exhaust, as the simple passage of some other gas through the tube, such as carbon dioxide, was sufficient to cause the transfusion to take place, though at a considerably less rate than exhausting. When a silver tube of less thickness than 1 mm. was used, the rate of transfusion was increased. Various other gases were passed between the tubes, but they only passed through the silver at a very slow rate. It is suggested that this quality of silver, of allowing oxygen to pass with comparative ease, may be some day made use of for isolating the oxygen of the atmosphere, for which purpose a very large surface would be required. Large coils of tubes with thin metal could be used, with either an exhauster or a current of carbon dioxide. If the latter, the carbon dioxide could be absorbed in alkali, leaving free the oxygen.

Steel Numbers.

In lieu of any really definite name for the different qualities of iron which are called "steel" in popular parlance, manufacturers have adopted a system of numbering that gives some notion of the condition of the product by designating the relative amount of carbon that the converted iron has received. It would be better if they would have suggested, also, other materials than carbon; for the best of steel is not only iron with a high and certain amount of carbon, but all steels must contain something besides iron and carbon to be workable and useful.

Soft and low steels are known from 0·10 to 0·76 of carbon; the lower grades are merely purified irons, with none of the qualities of crucible steel; they weld without flux, work soft at high heats, are not burned when approaching the welding heat, and are affected by sudden chilling in a cold bath only as iron would be. As the numbers approach a full per cent of carbon, the steel begins to act like crucible steel; requires a flux for weld, chills and hardens in water, and is capable of being tempered and of receiving a cutting edge. This method of designation is much better than the loose naming of the differing grades "iron" and "steel."

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WHALE FISHERY OFF THE COAST OF NORWAY.

There are, as well known, numerous fisheries of cod, herring, mackerel, etc., off the coast of Norway, but the most curious one is certainly that of the whale. This cetacean, which inhabits the polar regions, approaches the coast of Scandinavia about the month of June, in the train of numerous small fish called *lodde*, that come to the mouth of the rivers in order to deposit their eggs.

The whale that is fished off the coast of Finmark is the blue whale, an animal quite different from the species found in Greenland and called the right whale.

The fishing is authorized by Norwegian laws only from June to September. It is carried on quite near the coast, and a boat sometimes remains but two or three hours out of port. Thus, during the voyage of Oscar II. along the coast of Finmark, three whales were encountered between Vadso and Jacobselv. Another time a boat from Vadso captured one near the works established upon the small island opposite that city, that is to say, ten minutes' distance from the port.

Whale fishing in these regions is very ancient, as is proved by certain Norwegian legends, which relate that the giants who inhabited Finmark were of so great size and strength that they could take whales by the line. If they took two at once, they attached them by the tail and suspended them from their *hjelders*, as fishermen do with the cod that they are drying.

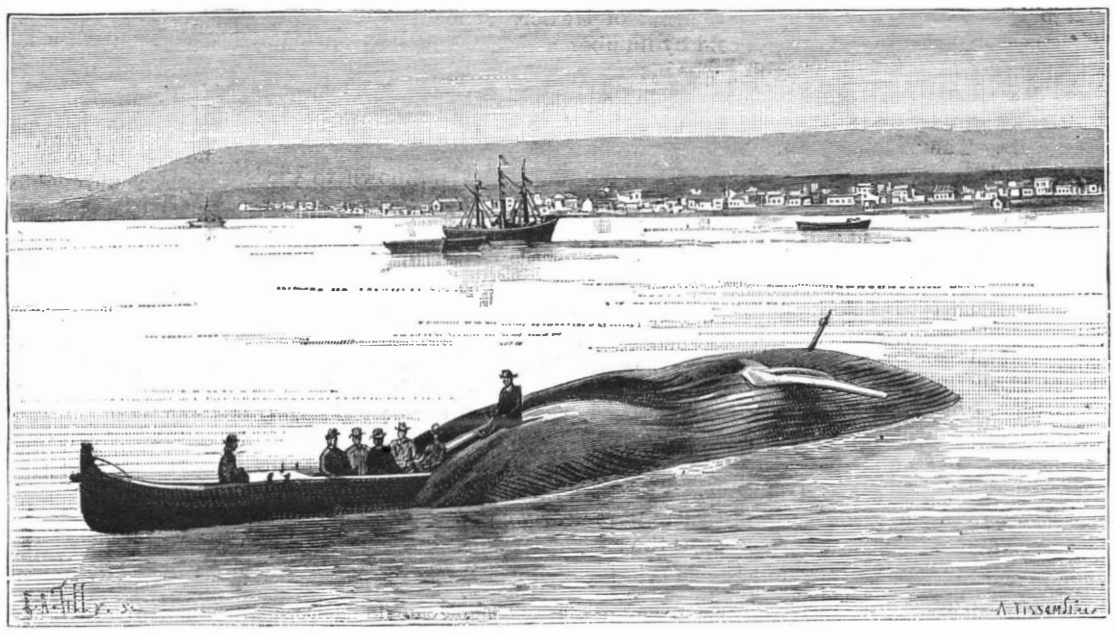

Fig. 1.—WHALE CAPTURED AT VADSO, AUGUST 15, 1884.

The great whale fishing industry was for a long time concentrated at Vadso, a small Finnic town of Varangerfjord. It is here that are located, upon the small island that we have mentioned, the establishments of the celebrated Mr. Foyn, the king of the whalemen. This person, who is still living, is a southern Norwegian, and was a sailor in his youth. Through his energy and intelligence he has acquired a fortune that is now reckoned by millions. At the epoch at which he began whale fishing it was not customary to bring these animals to the shore to strip them, but the fisherman who had taken one cut it up on the spot and lost many of the products. At this time only the whalebone and fat were utilized. Mr. Foyn conceived the idea of establishing himself upon shore, and of sending out small whaleboats to seek for these marine monsters, in order to bring them to his works, where nothing is lost, since, after the meat and fat have been removed for making oil, the detritus and bones are used for the manufacture of fertilizers. Mr. Foyn may be said to have established himself under excellent conditions, seeing that the whales come as far as to Varangerfjord, and that after a few hours' fishing it is certain that one or more will be brought it. It was he, moreover, who first utilized an invention that left far in the rear the antique harpoon thrown by hand from a fragile boat. The Foyn harpoon, which is a little over three feet long, is thrown by a small cannon placed in the bow of a steamship, 80 feet in length, with a crew of ten men.

This vessel, which costs between twenty and twenty-five thousand dollars, has a speed of 14 knots per hour. The cannon is pivoted, and carries a sort of stock that permits of pointing it in every direction. A cock, whose trigger is manipulated by a long cord, discharges the cannon at the moment desired. The cannon is aimed precisely like a rifle. The extremity of the harpoon is provided with a small steel-pointed bomb, which bursts after entering the whale's body. At this moment several rods, which up to this time had lain along the harpoon, spread out like the ribs of an umbrella, and prevent the rod from coming out of the animal's body. To the harpoon there is attached a long cable, which is coiled up in the hold, and which passes over several brakes actuated by steam.

The one who aims (who must be a very cool and skillful man) holds the butt of the gun with one hand and the cord that pulls the trigger with the other. When a whale has been sighted by the watcher at the masthead, the boat advances in the direction of the place where it has dived, so as to be ready to receive it at the spot where it will come to the surface in order to breathe. It is experience alone that teaches one to calculate the distance that the whale will travel between these two spots. In general, the whale is fired at from a distance of about 80 feet. It appears that the greatest difficulty is to strike the animal in such a way that the harpoon shall not pass through a certain part of the body, but shall be implanted therein and explode. This is why the cannon must not be heavily loaded.

When the animal perceives that it is struck, it suddenly dives, and uncoils the immense cable on board ship and carries it along with terrific speed. In order to oppose this the engine is reversed, and from each side of the ship, perpendicular to its sides, are spread out wings analogous to those found on Dutch boats. The whale sometimes goes to the bottom, and it is then difficult to raise it when the sea is rough. At the end of a certain time it returns to the surface to breathe. When it is dead, a boat with two men puts off to pierce its lower jaw and tail and attach an iron chain thereto. After this the animal is towed alongside the ship so that its head and tail are visible.

Foyn's land establishment consists of several parts. In the first the whale is carried to an inclined plane dug out of the rocks. When it is high tide and the animal is floating, the latter is attached by chains to rings set into the rocks. When the tide runs out, it leaves the whale on the inclined plane. At this moment men, armed with long knives affixed to the extremities of great handles (Fig. 2), begin to cut out long strips of fat from the animal's sides. When two parallel incisions have been made, a hook is attached to the most distant extremity. This hook is affixed to a chain that winds around a windlass moved by several men, who, combining their efforts, detach the strip of fat from the animal's body. They are aided in this operation by another man, who, provided with a long knife, cuts all the tissues that offer a resistance. When this strip is removed, it is placed upon the inclined plane until it can be taken up and carried to a large kettle, in order to convert it into oil. After the fat is removed, all the greasy matter possible is extracted. Then the lungs and intestines are removed and thrown away. It takes eight days to cut up one of these animals. In another place, chopping machines and mortars are installed under a shed that communicates with the ocean through an inclined plane. It is here that all the remains of these sea giants are reduced to a pulp in order to convert them into a fertilizer, which, later on, will find its way to the fields of Northern Germany.

On the day of our arrival at Vadso we went to visit the establishment, and Mr. Bull, Mr. Foyn's representative, did us the honors thereof. We were obliged to land at a slippery stairway, and had to perform miracles in the way of balancing in order to keep from falling. We first visited the inclined plane, but there was nothing curious in the aspect of this. Then, going along one of the rear buildings, we passed along a lot of kettles, in which were boiling debris of meat and fat, that gave out an odor calculated to make one sick at his stomach. From time to time great bubbles burst upon the surface, and gave out a still more nauseous and infectious odor, so that it became necessary to hold our noses.

A little further along, after passing over a small bridge covered with oily slush, we entered the shed that contains the mortars. Here it was still more frightful. In one corner there was a whale's head being cut up, and, as it was several days old, the emanations from it were something horrible. Men wearing great boots were working among these debris, which they carried to the mortars with immense hooks. They are so used to these surroundings that they do not smell anything. It was very difficult to maintain one's footing on the slippery ground here, which was covered with debris lying amid puddles of blood and grease mixed with mud. We had never seen anything so repulsive. We afterward took a tour in the fertilizer house, where the odor, which was as strong as under the shed, was much more disagreeable on account of its pungency. It was with pleasure that we breathed the ocean air, which, on our arrival, appeared to contain few pleasant odors.

Up to recent times the Vadso establishment had been the only one that existed in these regions, and so the profits from it were large; but, during the past few years, several companies have been formed in Norway and Russia, and especially at Vadso, so that, hunted beyond measure, the whale has rapidly diminished in numbers. Some assert that this diminution is due to the disappearance of the schools of small fishes that the animal was said to feed upon; but it has been really demonstrated that the whale does not eat them.—*R. Bonaparte, in La Nature.*

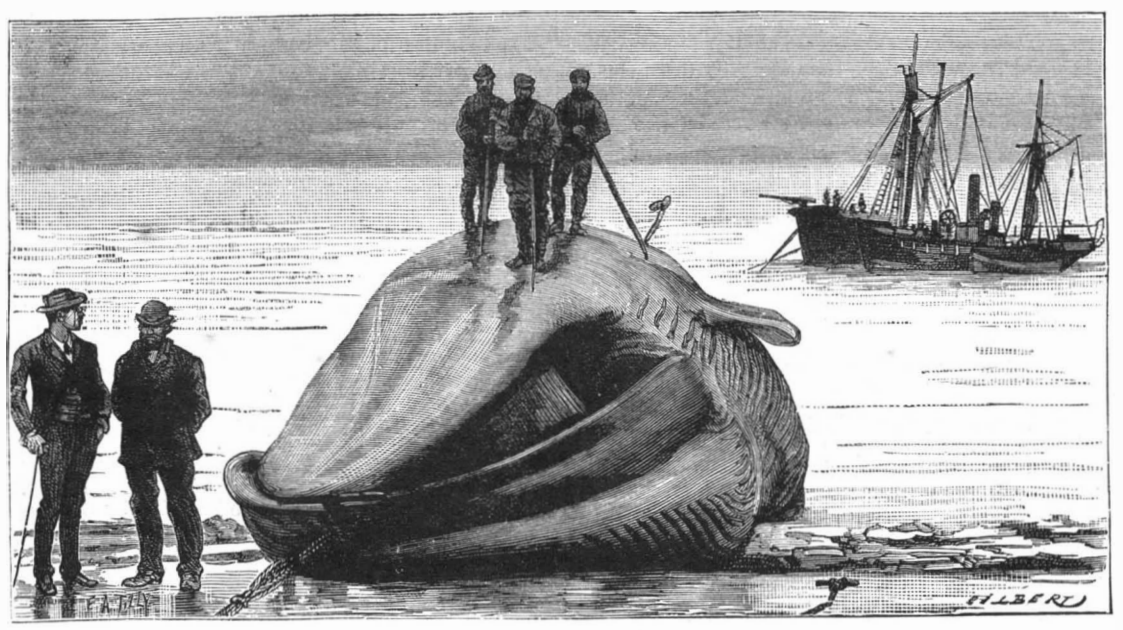

Fig. 2.—WHALE READY TO BE CUT UP.

A City Moving.

From recent surveys it has been ascertained that the entire city of Virginia, Nevada, has moved over thirty inches to the east since the big fire of 1875. The Maynard block, in Golden Hill, is known to be gradually sliding down in the direction of Gold Canon, and has moved nearly two feet since its erection. This movement is so gradual that it does not affect in any manner the safety of the building, as the ground to a depth of nearly one hundred feet to the bed rock is known to be continually sliding. It is a well known fact among practical miners that the ground on which Virginia City is built is what is termed a slide, and that it is necessary to sink nearly one hundred feet before finding the natural bed rock. These slides are caused by the constant crumbling of the rocks on the mountain sides. The debris thus accumulated through incalculable ages is constantly gravitating downward, and in a few hundred thousands of years what is known as the site of Virginia City will be nothing but barren bed rock, worn as smooth by the action of the elements as the southern slope of Sugar-loaf Mountain; and were it possible for structures built by human hands to withstand the decay of time, the entire city itself would then have been forced out on the flat between the mouth of Six-mile Canon and the Carson River.—*Virginia Chronicle.*

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Photographing by Artificial Light.

The light obtained by the burning of magnesium ribbon has been used extensively as an artificial light for photographic purposes, so that now, in consequence of the introduction of extra sensitive dry plates, it is possible for the amateur photographer to amuse himself during his leisure evenings by taking pictures as rapidly with this light as was formerly required by day light.

In place of magnesium ribbon, which is somewhat expensive, light produced by some cheaper pyrotechnic compound is said to answer a very good purpose. Referring to this subject, *The Photographic Times* remarks:

By far the best, as it is also the cheapest, source of light among the pyrotechnic compounds is that which has a time honored reputation as "signal fire," or very frequently as "Bengal light." This is composed of six parts (by weight) of saltpeter, two parts of sulphur, and one part of sulphide of antimony. In the preparation of this compound each must be powdered by itself, and the powder kept in dry canisters. They are then mixed together in the proportions given above. After a little experience has been acquired in the compounding of these substances, the weights and scales may be discarded in favor of measures representing the values of the respective weights.

The lantern in which the compound is burnt consists, in its most advantageous form, of a large parabolic reflector formed of tin, although we have known a common packing case to render excellent service. The front of the lantern ought to be from two to three feet across, and it must be covered with thin tissue paper. The back must have a small door through which is introduced the little cup that contains the requisite charge of the powder, there being a stand upon which to place this cup. The door at the back also serves for the introduction of a lighted match to ignite the powder when an exposure is about to be made.

It is an improvement when a small metallic chamber having violet glass in front is made the receptacle of the burning compound, as it prevents the interior of the large lantern from being incrusted with the smoke, and also causes the light emitted to be of a color that does not distress the eyes of the sitter. A capacious chimney must communicate with the burning chamber to insure the products of combustion being carried off.

The particular form of chimney we employ for both this purpose and the ignition of magnesium is one which we can strongly recommend. It is formed of calico, which is kept distended by a spiral spring made of fine wire. Its diameter is between three and four inches, and the length sufficient to reach any window or chimney within twelve or fifteen feet of the lantern. In the case of a window it is merely opened a little at the top and the end of the flexible chimney projected, and kept in position by means of a pin. The flexibility of this chimney permits of its being easily packed away when not in use.

The lantern must be placed upon a stand so as to be a little higher than the sitter. When a spoonful of powder is placed in the cup and ignited, the front of the lantern becomes practically a highly luminous artificial cloud throwing a powerful light upon the sitter, yet without any strong shadow being cast. This exemption is secured by the large diameter of the front of the lantern. The intervention of the violet glass and of the tissue paper causes the light which falls on the sitter to be soft and agreeable. White reflectors may be placed at the side of the sitter at the taste of the operator. Owing to the actinic power of the light a brief exposure suffices, usually from two to five seconds proving enough. As but little of the compound is required to give a light of such brief duration, this system of lighting is strictly economical.

Ancient Mexican and Central American Measures.

Professor Daniel G. Brinton, in a paper lately read before the American Philosophical Society, gives many interesting facts. Among other observations he says:

Whatever the lineal standard of the Aztecs may have been, we have ample evidence that it was widely recognized, very exact, and officially defined and protected. In the great market of Mexico, to which thousands flocked from the neighboring country (seventy thousand in a day, says Cortes, but we can cut this down one-half in allowance for the exaggeration of an enthusiast), there were regularly appointed government officers to examine the measures used by the merchants and compare them with the correct standard. Did they fall short, the measures were broken and the merchant severely punished as an enemy to the public weal.

The road measures of the Aztecs was by the stops of the carriers, as we have seen was also the case in Guatemala. In Nahuatl these were called *neceuilli*, resting places, or *netlatolli*, sitting places; and distances were reckoned numerically by these, as one, two, three, etc., resting places. Although this seems a vague and inaccurate method, usage had attached comparatively definite ideas of distance to these terms. Father Duran tells us that along the highways there were posts or stones erected with marks upon them showing how many of these stops there were to the next market towns—a sort of milestones, in fact. As the competition between the various markets was very active, each set up its own posts, giving its distance, and adding a curse on all who did not attend, or were led away by the superior attractions of its rivals!

So far as I have learned, the lineal measures above mentioned were those applied to estimate superficies. In some of the plans of fields, etc., handed down, the size is marked by the native numerals on one side of the plan, which are understood to indicate the square measure of the included tract. The word in Nahuatl meaning to survey or measure lands is *tlalpoa*, literally "to count land," from *tlalli* land, *poa* to count.

The Aztecs were entirely ignorant of balances, scales, or weights. Cortes says distinctly that when he visited the great market of Mexico, Tenochtitlan, he saw all articles sold by number and measure, and nothing by weight. The historian Herrera confirms this from other authorities, and adds that when grass or hay was sold, it was estimated by the length of a cord which could be passed around the bundle.

The plumb line must have been unknown to the Mexicans, also. They called it *temetztepilolli*, "the piece of lead which is hung from on high," from *temetztli*, lead, and *piloa*, to fasten something high up. Lead was not unknown to the Aztecs before the conquest. They collected it in the Provinces of Tlachco and Itzmiquilpan, but did not esteem it of much value, and their first knowledge of it as a plummet must have been when they saw it in the hands of the Spaniards. Hence their knowledge of the instrument itself could not have been earlier.

Prof. Brinton's conclusions are as follows:

1. In the Maya system of lineal measures, foot, hand, and body measures were nearly equally prominent, but the foot unit was the customary standard.

2. In the Cakchiquel system, hand and body measures were almost exclusively used, and of these, those of the hand prevailed.

3. In the Aztec system, body measurements were unimportant, hand and arm measures held a secondary position, while the foot measure was adopted as the official and obligatory standard both in commerce and architecture.

4. The Aztec terms for their lineal standard, being apparently of Maya origin, suggest that their standard was derived from that nation.

5. Neither of the three nations was acquainted with a system of estimation by weight, nor with the use of the plumb line, nor with an accurate measure of long distances.

Incidentally Prof. Brinton, after comparing the old Central American measures with those of the mound builders of the Ohio Valley, concludes that the "mound builders" probably used a ten-foot measure to lay out their works.

An Unsatisfied Want.

I want a planer with plenty of backbone in it; and to get this there must be no niggardly economy of iron. The platen must be heavy and stiff, and must not run far off the ways at the ends. The ways should have plenty of surface, so as not to squeeze out the oil, and cut under a heavy load. The rack and gears should be cut so as to run without back lash; for I do not want gear marks on my work after a finishing chip. I want the square holes for bolts and the round stop holes planed and reamed to gauge, so that fitted bolts and stops will fit all the holes. As to the stop holes, it is heathenish to use a hammer; the stops should be pushed home by the hand; we are not splitting logs when we are fastening work to the platen.

I want the crosshead with plenty of bearing surface on the uprights, so that a trifle of wear on the lower end will not unfit the crosshead for higher work. I want the gibs, both in the crosshead and in the saddle, made wedge shaped, so that I can adjust them with one screw on the end instead of using half a dozen screws on the side, which require much time to adjust evenly.

I want the shipping motion to work alike and exact, so that in planing plump up to a shoulder I shall not run against it and break the tool or smash the work. The feed motion should be positive, so that if I require a feed of just one tooth it shall be exactly one tooth, and a feed of twenty teeth shall be twenty teeth, not twenty and one-half with a slip back of half a tooth, or twenty teeth this time and twenty-one the next time.

I want the planer geared so that I can take a heavy chip without the planer winking. I want a solid foundation for the machine, on masonry piers, if necessary down to hardpan, so that the passing of a loaded truck over the floor will not spoil a finishing cut. I want the speed changeable by an extra countershaft, so that I may change from working rigid steel to soft composition; and with these qualities in a planer I can do a good job.

These are the complaints and opinions of a machinist that has run planers for thirty years, and they possibly contain suggestions that may be of value to machine tool builders.

"Read Less; Think More."

The late Charles O'Conor, perhaps the most profound lawyer New York city has produced, gave a piece of advice to a young man which is as valuable as any legal opinion for which the distinguished lawyer ever received a fee. A lad wrote to him, giving a long list of books which he had already gone through, and asking advice as to a course of reading. Mr. O'Conor replied that "he had not only not read, but had not known even by name one-half of the books his correspondent appeared to have read. He would not therefore, undertake to advise him what to read, but he could safely advise him to read less, and think more." This anecdote comes from a recent number of the *Century*.

The advice was not, however, original with Mr. O'Conor. In the Philadelphia *Ledger* some time since an older authority was quoted to the same purport. Probably the same sound wisdom could be traced back to the time of the invention of printing. "Read less (of trash) and think more" has a pithiness which makes the advice all the more easy to keep in mind. And following it would enable the "temperate" reader not only to think, but to remember more of what he reads. Remembering more would give a practical value to the ideas acquired and the facts obtained. Perhaps Mr. O'Conor's opinion on reading is to be qualified a little by his practice. It seems that his reading was very much confined to the purposes of his profession. No doubt this limit increased his wonderful efficiency in his legal pursuits. But it would be a great abridgment of mental freedom to restrict the reader to his specialty and forbid excursions outside of that. The mind is enlarged by a variety of topics, and there is scarcely any subject, however foreign to a thinking person's daily life, from which he may not derive some advantage. There is nothing in the way of learning which stands so much alone that it cannot be illustrated by other and indeed apparently dissimilar matters. Still the caution holds good—to most readers—"read less and think more."

Lacing Belts.

The market is full of devices for fastening the ends of belts, but there seems to be no diminution in the importation of Patna hides and the use of leather lacings. Lacings are absolutely necessary in remaking once used belts, as after the belt has been oiled the cement ceases to "take," and the riveting of scarfs is very unsatisfactory. But in many instances the butting of belts is preferably done with lacings. The belt awl—or awls, for there are several patterns—as generally in use, is not properly shaped. It depends on a point to start a hole, and enlarges the hole by the larger round or lozenge-shaped section. This tears and crowds the fibers of the leather, and tends to cockle the belt. The belt awl should be patterned after a mortising chisel, except perhaps that the edge need not be of the entire width of the blade, and the blade may be slightly curved for ease in handling. A sharp chisel edge will cut a clean hole, or rather a slit, which may be opened for the passage of the lacing, and not being a violent disturbance of the leather, the slit will close firmly around the lacing when it is in place. The temporary spreading of the hole crosswise may be made by the thicker cross section of the awl, corresponding to the flattened lozenge of the mortising chisel. In butting belts, however, the first row of holes should be made with the punch, and a triangular punch is better than the common round punch, one of the faces of the triangle to be in line with the cross cut of the belt.

Unless absolutely necessary to "take up" or mend a belt in working hours, it is best not to run it off the pulleys for this purpose. It is always mere guesswork to know how much to cut out of a slack belt when it is off its pulleys, and it is not uncommon to have the job to do over, sometimes more than once. Taking up belts should be deferred, if possible, to a nooning or the shutting down of the works. Then a pair of clamps should be used to bring the open ends of the belt together while the belt is on its pulleys. There are clamps for this purpose that do not require the use of wrenches; the jaws are always in line (parallel), dispensing with the use of the straight edge, and they are actuated by a crank. Except for very wide belts, these clamps can be handled by one person. By their use the exact tension of the belt can be secured, its perfect line preserved, and a clean joint made with the belt in the handiest possible position for working on it.

Wind Mills.

An 8½ foot wheel will raise 3,000 gallons of water daily a distance of 25 feet. Its first cost, including pump and a plain tower, is about $150. A 10 foot wheel will raise about 9,000 gallons of water a day a like distance, and cost about $180, including the appurtenances above mentioned. A 12 foot wheel will raise 16,000 gallons of water per day the above distance, and cost with the same appurtenances $210; so up from 14 to 16, 18 to 20 feet diameter of wheel until we reach a 25 foot wheel, which costs about $1,200 and will raise 100,000 gallons of water daily the specified distance.

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ENGINEERING INVENTIONS.

A car brake has been patented by Mr. Charles E. Currie, of Butte, Montana Ter. It is adapted to be used by hand, and provides means whereby the hand shaft may be automatically locked at any point, or released by the operator's foot with ease as desired, the locking device being protected from dust and dirt.

A propeller has been patented by Mr. John Wooll, of San Francisco, Cal. This invention consists of the paddle traveling between ways or bars carried by a shaft, the paddle moving through said shaft and acted upon by a cam groove, to cause the paddle to perform its return movement with a minimum resistance to the water.

A car coupling has been patented by Mr. John C. Yeiser, of Junction City, Ky. This invention relates to car couplings in which the ordinary link and pin are used, and consists in improved means for holding the link in proper position for entering the drawhead of the opposite or approaching car without the necessity of an attendant going between the cars for the purpose of placing it.

A blow off for steam boilers has been patented by Mr. Stephen A. Moore, of Springfield, Ill. It consists of an exterior valved pipe, and an interior pipe connected thereto, having longitudinal straight slots on the lower and opposite sides of the center of an area not exceeding that of the valved pipe, to insure action in blowing out dirt and sediment throughout the length of the boiler.

A piston packing has been patented by Mr. Jackson Garrison, of Milnes, Va. This invention relates to pistons working where metallic rings are used for packing, the construction being specially devised so the packing rings may be readily adjusted to the degree of tightness necessary to make a perfect working fit, and to reset from time to time, as required by the wearing of the cylinder and the rings.

A feathering paddle wheel has been patented by Mr. John P. Hickey, of Washington, D. C. This invention covers special details of construction and combinations of parts for paddle wheels for steamboats, by which the paddles or floats are in position to press against the water as soon as they enter it, and continue in that position as long as they can produce any useful effect.

A car coupling has been patented by Messrs. Thomas T. and James M. Deavenport, of Okolona, Miss. The drawhead has at its front upwardly and inwardly inclined prongs, on which the link catches when the cars are coupled; in a slot in the bottom of the drawhead a link lifter is pivoted, which can be locked in place by a pawl mounted on a transverse shaft in the drawhead, the shaft having its end bent and a heavy weight thereon, which weight is connected by a chain with a lever pivoted on the end or top of the car.

AGRICULTURAL INVENTIONS.

A potato digger has been patented by Mr. Burton D. Prentice, of Castalia, Ohio. Its construction is such that when the machine is drawn forward with the scoop in working condition the potatoes and soil are passed back upon bars, by the shaking of which the soil is liberated and the potatoes fall on the ground at the rear ready to be gathered.

A check rowing attachment for corn planters has been patented by Mr. William S. Reeve, of Edwardsport, Ind. It is made with a frame carrying a wheel with cams attached to its journals to operate unequal sliding rods connected by an equal armed lever, the longer rod connected with the seed dropping slide of a planter by an elbow lever, so the slide will be operated by the revolution of the wheel.

MISCELLANEOUS INVENTIONS.

A fan attachment for elevators has been patented by Mr. Richard Marshall, of Brooklyn, N. Y. It consists principally of suitable gearing arranged to be revolved by the up and down movement of the elevator cage, to operate a fan at the top of the cage, and thus promote the comfort of the passengers.

A combined lapel vest and overshirt has been patented by Mr. Abe W. Mensor, of Jacksonville, Oregon. It provides different exposures of the bosoms and cuffs on its right and left hand sides, having duplicate bosoms and cuffs, whereby the same garment is made to answer different uses.

A safety vent for beer kegs has been patented by Mr. Niels Olson, of Perth Amboy, N. J. This invention covers a specially constructed safety vent and air pipe, to facilitate the drawing of the liquid from the keg and provide for the escape of the gases, so as to keep the liquid in fresh condition and avoid waste.

A ventilating cover has been patented by Mr. Ralph J. Smith, of San Marcos, Tex. A ventilating tube projects upward from the cover, with gauze on the upper end of the tube and a casing surrounding it, so the contents of vessels may be protected from dust, insects, etc., and at the same time be thoroughly ventilated.

A window blind slat holder has been patented by Mr. William Jensen, of Victoria, British Columbia. It is a single piece of wire bent to form an upright spring portion or arm and a horizontal spike portion adapted to be driven into the cross piece of a window blind, notches in the holder engaging with stops to hold the slats in any desired position.

A brake shoe clamp has been patented by Mr. Leander King, of Georgetown, Ohio. On the side edges of the brake block are clamps secured at the top and bottom, those parts of the clamps projecting from the face of the block being inclined toward each other and adapted to receive and hold the brake shoe between them.

A lubricating compound has been patented by Mr. Dyson D. Wass, of New York city. It is composed of paraffine, mineral oil, and talc, compounded in a specially described way, and to which alcohol may or may not be added, making a compound which is clean to use and does not gum up the parts of the machinery.

A wagon box has been patented by Mr. Jesse F. Ruhl, of Topeka, Kan. This invention covers a special construction and arrangement to hold the detachable sides of wagon boxes securely in place, and whereby a close and tight joint will be formed in such wagon boxes, to prevent grain, sand, etc., from working through.

A door closer has been patented by Mr. John McDonald, of Middletown, Ohio. Combined with a rotary bearing block, a crank shaft journaled therein, with a weight attached to one end, are means for connecting the crank shaft with a door, with other novel features, the device being such as can be made in one piece with the door hinge.

An apparatus for watering swine has been patented by Mr. Hermann H. Wempe, of Capioma, Kan. It is so constructed as to prevent the animals from lying down in the trough, and so that water may be conveniently supplied at will or automatically, the distinguishing feature being in the form and arrangement of the water receptacle.

A spring gear for vehicles has been patented by Mr. Benjamin P. Morrison, of Marion, Va. This invention consists in equalizing gear applied in connection with springs of the Concord pattern, the gear being inexpensive and durable, and such that by its use the usual perch side bars, axle beds, fifth wheel, bolster, and body loops are dispensed with.

An improvement in the manufacture of cut nails has been patented by Mr. John Young, of Wheeling, West Va. This invention provides a new form of die for shaping the nail about the head, so its strength will be re-enforced, and thus prevent the heads from being so frequently broken off in driving as has been the case heretofore.

A fence has been patented by Messrs. Andrew J. Russell and William M. Goolden, of London Bridge, Va. The object is to construct a strong fence without nails or screws, which shall be portable in finished sections and be easily and cheaply made, the stakes, rails, and posts for this purpose being wired together to form a rigid framework.

A saw clamp has been patented by Mr. A. Floyd Delafield, of Noroton, Conn. Combined with two bars and a screw for clamping them together and against the saw blade placed between them is a handle on which the clamp thus formed is held, making a device by which short pieces of saws may be used for sawing through pieces of metal or tubes.

A centrifugal ore filter has been patented by Mr. Thomas T. Eyre, of Carlisle, New Mexico. This invention covers a special construction and arrangement of parts to maintain centrifugal action in the semi-fluid ore until the valuable properties have been withdrawn, to introduce water, gaseous, and other fluids as may be required, and to discharge the valuable properties and the refuse matter from different outlets.

A cartridge belt has been patented by Mr. Willie P. Beach, of El Paso, Texas. This invention consists in the combination, with a belt, of a strap held on the same by upright metal fasteners and forming pockets on the belt, a cord being passed transversely through the several pockets, with other novel features, to form a simple, strong, and durable cartridge belt.

A shutter fastener has been patented by Mr. John Von Hollen, of Charleston, S. C. It consists in a shutter bolt made in two parts, screwed to each other, and having a conical head, behind which the latch bar on the shutter drops to lock the shutter open, the invention affording a wide range of adjustment of the extensible bolt catch with but few sizes of the bolt.

A shutter bolt has been patented by Mr. John Von Hollen, of Charleston, S. C. This invention consists in providing a collar near the inner conically headed end of the extensible catch of the bolt, the collar serving as a bearing for the inner end of the bolt in the hole made in the window frame or wall, for securing bars over closed window shutters or blinds, and for other purposes.

A drop light and chandelier has been patented by Mr. John Trigge, of Mount Vernon, N. Y. The chandelier has an extension or drop light with rack teeth engaging with cog wheels in a box, one of the wheels being connected by an automatic clutching device with a disk on which a brake spring or lever rests, to prevent the drop light from sliding down when once adjusted.

A powder keg discharge tube has been patented by Mr. Augustus H. Whitman, of Minersville, Pa. Combined with a tube having a flange around its lower end, and with a slot in its side, is an inner tube with a shoulder around its lower end, and with a side pin engaging with the slot in the outer tube, so the discharge tube can be snugly secured to the head of the powder keg, and readily detached.

An amalgam strainer has been patented by Mr. Jeremiah Kirby, of Marysville, Montana Ter. This invention provides a new kind of top for the funnel-shaped canvas bags used for separating quicksilver from gold and silver amalgam, so that when the canvas is worn it will not have to be cut off and resewed around the iron ring, but can be readily released and readjusted with a ring and thumb screws.

An upright-beater baling press has been patented by Mr. John J. Piatt, of Rising Sun, Ind. It is made with one or more knives attached to the beater, to cut each feed into two or more parts as it is compressed by the beater, and thus form two or more small bales at one operation without any increase of labor over that required for a single large bale as heretofore formed in such presses.

A bridge has been patented by Mr. William O. Douglas, of Binghamton, N. Y. This invention combines a tension floor line chord with a strut brace, so that a point in the end post is rigidly fixed to resist the pull of the chords, and both flanges of the wind truss will always be in tension, the invention being more especially designed for parabolic truss bridges, to cheapen their cost and increase their efficiency.

A candlestick has been patented by Mr. Elijah Carpenter, of Lafayette, Oregon. Combined with a candlestick having a stationary post and a sleeve to slide vertically therein there is a spring within the post, having a nib projecting through a hole in the post to bear against the inner face of the sleeve, thus supporting the candle in an upright position while burning, and serving as a handle by which it may be carried.

An aerial drop for explosives, to be used in connection with a suitable balloon, and its motion regulated by a time mechanism, has been patented by Mr. Moses L. S. Buckner, of Shelbyville, Ky. The propelling mechanism is on the clockwork principle, and the apparatus is set according to the course of the wind and the distance of the enemy, which it is expected can thus be reached at greater distances than explosives can now be thrown.

A top plate for bone black kilns has been patented by Mr. Edward P. Eastwick, of New York city. This invention consists principally in making all of the surfaces of the covering plates flaring or inclined toward the openings that direct the bone black into the retorts, preventing the lodgment thereon and obviating the necessity for sweeping the lodged bone black from time to time into the openings.

A draught regulator has been patented by Mr. George W. Lore, of Fayette, N. Y. It consists of a casing formed with two truncated hollow cone-sections united at their bases and having their truncated ends connected with the ends of the pipes, which extend into the cone sections only sufficient to unite them, and the bottom cone section having a series of apertures which can be closed by a valve.

A pill counter has been patented by Mr. David B. Moore, of St. Louis, Mo. It consists of a flat strip of wood or other material with perforations corresponding with the number of pills to be counted, with a trough which answers as a bottom for the pill cavities and as a discharging spout for guiding the pills into the box or package into which they are to be discharged.

An apparatus for delivering clean water into cisterns from roofs of buildings has been patented by Mr. Francois Sancan, of Thibodeaux, La. A water receiving vessel is located in the line of the pipe which discharges water into the main cistern, this vessel having a tapering neck and float valve, which rises and cuts off communication when the receiving vessel is full with the water first coming off the roof in a storm, after which the roof drainage flows into the main cistern.

A saw swage has been patented by Mr. Thomas Newnham, of Wainright, Ga. This invention provides a simple and efficient swage for setting the saw teeth from the under or throat edges, thereby insuring better working clearance of the teeth, and one which will set the teeth gradually, and by a rolling action of the swaging die, allowing hard or brittle saw teeth to be set without breaking or cracking their points.

A shoe fastening has been patented by Mr. Henry H. Rodman, of Wilkesbarre, Pa. The opening in the shoe is at the back of the heel, where the tongue is passed through clips in such a manner that as the tongue is drawn downward the rear of the shoe can be opened for the foot to enter, but when the shoe is to be closed the tongue is drawn upward through the clips, and straps projecting from one end of the tongue are passed around the ankle to fasten in front.

A tentering machine has been patented by Mr. Andrew McLean, of New York city. In combination with the guide roller and regulating roller and means for revolving them, are independent stretching and feeding wheels, so the main operative parts will not be revolved by positive power, but by frictional contact with the rollers of the wet or starched cloth being drawn through the machine by the cylinders of the drying machine, the differential movement of the surfaces of the rollers exerts a powerful action, and the cloth is properly stretched in all directions.

An improved lamp wick has been patented by Mr. Ives Lynd, of Troy, N. Y. It may be knit in an ordinary knitting machine, but is so designed as to form straight longitudinal ribs upon the sides of the wick, with intermediate passages, which extend the whole length of the wick, and are entirely unobstructed, so as to furnish continuous ducts or small tubes through which the oil is drawn freely to the blaze. The wick is cheaply made, and is intended to furnish the greatest possible amount of light from heavy as well as from light oils, the easy flow of oil to the flame preventing charring and crusting of the top of the wick, the latter being so porous that the oil is always fed abundantly enough to prevent this, a desideratum which has been much sought after of late. These wicks may also be used in oil reservoirs for conducting oil to journals, boxes, and bearings of all kinds to be lubricated.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

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If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40. Various other foreign patents may also be obtained. For instructions address Munn & Co., SCIENTIFIC AMERICAN patent agency, 361 Broadway, New York.

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Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 254.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, polishing compositions, etc. Complete outfit for plating, etc. Hanson, Van Winkle & Co., Newark, N. J., and 92 and 94 Liberty, St., New York.

For Steam and Power Pumping Machinery of Single and Duplex Pattern, embracing boiler feed, fire and low pressure pumps, independent condensing outfits, vacuum, hydraulic, artesian, and deep well pumps, air compressers, address Geo. F. Blake Mfg. Co., 44 Washington, St., Boston; 97 Liberty St., N. Y. Send for catalogue.

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Supplement Catalogue.—Persons in pursuit of information of any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Curtis Pressure Regulator and Steam Trap. See p. 285.

Woodwork'g Mach'y, Rollstone Mach. Co. Adv., p. 284.

Wood Working Machinery. Full line. Williamsport Machine Co., 110 W. 3d St., Williamsport, Pa., U. S. A.

Iron and Steel Drop Forgings of every description. Billings & Spencer Co., Hartford, Conn.

We are sole manufacturers of the Fibrous Asbestos Removable Pipe and Boiler Coverings. We make pure asbestos goods of all kinds. The Chalmers-Spence Co., 419 East 8th Street, New York.

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Barrel, Keg, Hogshead, Stave Mach'y. See adv. p. 270.

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NEW BOOKS AND PUBLICATIONS.

RUSSIA UNDER THE TZARS. By Stepniak. Rendered into English by Wm. Westall. New York: Charles Scribner's Sons, 1885.

In this vivid picture of the galling despotism of the Tzars, the well-known Nihilist has struck a vulnerable point in the Russian autocracy. Such a burning account of atrocious wrongs must claim the attention of Christendom. It is an appeal to the power of public opinion. The Russian government, though entirely oblivious to the tears of a whole province, is curiously sensitive to foreign criticism. It is this sole vibratory chord which Stepniak has touched. His account of the present tyranny is accentuated by a brief sketch of Russia's ancient liberty. The description of the village *Mir* and provincial *Vetche* are interesting studies in social economy. The contemptible detective service which the government has stooped to organize, and the mockery of Russian law, are introductions to the horrors of Siberia and the fortress of Peter and Paul. But the main portion of the book is devoted to the evils which fall even on those obedient subjects who are innocent of the love of liberty. In Russia it is a crime to be suspected. No one can be free from the dread of administrative exile. The censorship of the press and the discouragement of education, so essential to autocratic rule, are formidable barriers to the progress of civilization. Coming just at this time, when the eyes of the world are fastened upon Russia, this book will interest many readers, and, it is to be hoped, will accomplish something for her liberation.

THE DISTILLATION AND RECTIFICATION OF ALCOHOL, AND THE PREPARATION OF ALCOHOLIC LIQUORS, ETC. By William T. Brannt. Henry Carey Baird & Co., Philadelphia.

The distillation and rectification of spirits properly occupies the major portion of this volume, and is treated in a simple but comprehensive way, bringing the whole subject within the understanding of any one of ordinary intelligence. Yet we doubt whether this portion of the book will be so much appreciated as will be the chapters on the preparation of liquors and cordials, which explain how easy it is to fabricate from pure spirits a wide variety of liquors, such as Cognac and other brandies, Hollands gin and Schiedam schnapps, Scotch, Irish, old Bourbon and other whiskies, cordials, bitters, etc. The thousands of imitations of "genuine imported" or "old stock" liquors in the market render it not easy for even an expert to judge of the various qualities; but the importance of extreme care in this respect may be judged when we note that among the materials used in these liquors are, besides a wide variety of nut shells, allspice, cinnamon, etc., such additions as turpentine, spirits of niter, citric and acetic acids and acetic ether, fusel oil, creosote, and many others of the same kind. It is difficult to estimate the consumption of these fabricated liquors or their effects upon the individuals who take such compounds into their stomachs; but it is safe to say that if every one who has heretofore helped to increase their sale could be made aware of the facts, there would be a decided "drop" in the liquor market.

APPLIED MECHANICS. By Gaetano Lunza. John Wiley & Sons, New York.

As a text book for students of engineering, this volume, by a Professor in the Massachusetts Institute of Technology, Boston, will prove a most useful assistant. It is largely a treatise on strength and stability, and the topics are arranged in such manner as was deemed most convenient for the classes of the institution in which the author taught. The contents embrace chapters on the composition and resolution of force, dynamics, roof and bridge trusses, center of gravity, strength of materials, continuous girders, equilibrium curves, arches, and domes, and theory of elasticity and applications. The reported tests of iron, steel, and timber, for a wide variety of uses, embrace a large number of the most carefully made trials of recent date, and the explanations and criticisms thereof are such as to increase the practical value of the information thus afforded.

TWENTY YEARS WITH THE INDICATOR. Vol. II. By Thomas Pray. John Wiley & Sons, New York.

This work, as was the first volume by the same author, has been compiled from a very extensive practice in testing engines of almost every kind and for nearly all varieties of work for which they are employed. The indicator in the hands of an intelligent engineer is a simple device, which should be easily managed to give valuable readings as to the working of an engine and the economical use of steam, but there are many who fail to employ it rightly, or correctly deduce from the cards the evidence they give, and to all such this volume details experiences likely to be of practical service.

STEAM USING, OR STEAM ENGINE PRACTICE. By Charles A. Smith. The *American Engineer*, Chicago.

This work is a companion volume to "Steam Making," by the same author, the two books forming a valuable addition to the literature of this subject. The book is a great deal more practical than theoretical, the chapters on valves and valve gear, and on different varieties of engines, with the illustrations of details and citations of experiments, containing a great deal of interest and value.

THE PHŒNIX BRIDGE COMPANY, of Phœnixville, Pa., have recently issued a handsome illustrated album of designs of bridges, with detailed descriptions. The list of wrought iron bridges, viaducts, and piers built by the company covers some of the most important work of this character ever built in the United States and Canada. The distinctive features of American bridge work—elaborate bracing, no extra use of material, and, consequently, light and graceful forms of structure as well as great strength—are well shown in the views of their bridges here given. David Reeves is the President of the Company, and Adolphus Bonzano Vice President and Chief Engineer.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
Special Information requests on matters of personal rather than general interest, and requests for **Prompt Answers by Letter,** should be accompanied with remittance of $1 to $5, according to the subject, as we cannot be expected to perform such service without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Minerals sent for examination should be distinctly marked or labeled.

(1) W. M. B.—The wood of pickle kegs may be protected by coating it with paraffine. Bottles, however, are the best vessels in which to preserve pickles. A beautiful green color entirely destitute of any poisonous qualities may be made by dissolving 5 grains saffron in ¼ ounce distilled water, and in another vessel dissolving 4 grains indigo carmine in ½ ounce distilled water. After shaking up each thoroughly, they are allowed to stand for 24 hours, and on being mixed together at the expiration of that time a fine green solution is obtained, capable of coloring pickles, etc.

(2) C. H. R.—An oil cloth should never be scrubbed with a brush, but after being swept, should be cleaned by washing with a soft flannel and lukewarm or cold water. On no account use soap or water that is hot, as either would have a bad effect on the paint. When the oil cloth is dry, rub it well with a small portion of a mixture of beeswax softened with a minute quantity of turpentine, using for this purpose a soft furniture polishing brush. The following is also used to keep oil cloths looking well: Wash them once a month in skim milk and water, equal quantities of each. Rub them once in three months with boiled linseed oil. Put on a very little, rub it well in with a rag, and polish with a piece of old silk.

(3) H. V.—There is probably no special book treating of the separation of gold and silver from their ores by means of electricity. In a small way gold and silver are thrown down from solutions containing them, as in the plating processes, but such a line of operation would hardly meet with success in treating ores. The same is true of mercury; the general process of obtaining mercury from its ores is by distillation. We would suggest that you consult some of the many books on metallurgy.

(4) G. D. writes: Please inform us how many lines of nonpareil type, 13 ems pica width, it takes for 1 square. Also how we can find the number of squares in nonpareil, when the matter is set in bourgeois same width? We have county printing to do, and they pay at so much a square, nonpareil type. We don't have nonpareil enough to set it in, and have to use bourgeois, and we are unable to find any rule, or any one who knows how to measure it? A. A printer's "square" for measuring advertising space in a newspaper is a term of variable meaning, always requiring fuller definition to express its exact quantity of space. It is customarily used in connection with the particular type and measure of the paper, as "a square of 12 lines agate," or nonpareil, or any other kind of type, and really means only a space of that extent, not in any way a mathematical square of space in the paper. It first came into use as designating a small space for a business card, and has been largely used by printers, more especially in small country papers—the "square" being generally stated to mean a particular space varying from about 10 to 14 lines, and of the size type used for advertising in the paper, from agate to long primer. Your square of nonpareil should mean a definite number of lines, and then measure by this rule the space occupied by any other kind of type, larger or smaller.

(5) D. W. L.—With a well made boat, on smooth ice, an ice boat will travel much faster than the wind. For example, a twenty mile breeze will drive the boat with a velocity of 40 miles per hour or more.

(6) C. E. A.—A good quality of printer's ink brought to the proper consistency with linseed oil is the best article to use with pad for rubber type. Nigrosine black dissolved in water and mixed with sufficient glycerine is likewise employed, but it is not as good as the former.

(7) A. S. writes: Do you know of any paint that can be applied to posts, that horses will not touch? A. We do not know of any but such as it would be objectionable to use.

(8) R. F. E., Jr.—The Carre ice machine is made by the Richmond Iron Works, Philadelphia. The medium used is simply a strong solution of ammonium hydrate, the principal point throughout the operation being that as the liquid ammonia is rendered gaseous it absorbs the sensible heat from the water to be frozen.

(9) R. H. D. asks: In what proportion to mix tincture of cantharides and glycerine for the prevention of baldness? A. An excellent hair tonic consists of as follows: Scald black tea, 2 oz., with 1 gal. boiling water; strain, and add 3 oz. glycerine, tincture of cantharides, ½ oz., and bay rum 1 qt. Mix well by shaking, and then perfume.

(10) H. J. C. writes: 1. The gas carbon dioxide (CO_2) is present in air to extent of nearly 4 per cent, and is soluble in water (1 liter of water at 15° dissolving about 1 liter CO_2). Notwithstanding this, it is found that even after long rains the amount of CO_2 in the air at any particular locality remains practically unchanged. What is the reason? A. Ordinary rain contains carbon dioxide which it has dissolved out of the air. The amount absorbed by the rain could not but be infinitely small under ordinary circumstances, and moreover the sources of its origin are constant. 2. How would you define flame? A. Burning vapor or gas. See also Webster. 3. At low temperature the gas nitric peroxide (N_2O_4) condenses to an almost colorless liquid. Upon increasing the temperature the color deepens to yellow and brown. Why? A. The various shades assumed by the nitrogen peroxide are due to impurity or dilution, for as a liquid it is colorless, but as it expands by the heat it takes more air, becomes more oxidized, and therefore colored to a greater degree, just as the iron oxide, which is black when anhydrous, as in certain varieties of hematite, but, as it becomes hydrated and mixed with water, it changes to red. and so on through various shades to the light yellow ochers. The colors are properties of the substances.

(11) J. B.—Rubber is generally pressed in iron moulds. A little soapstone is first thrown into the mould to prevent the rubber from adhering to the mould. Full information on the India rubber industry is given in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 249, 251, 252.

(12) F. N. O. asks for the preparation used to stick together the edges of paper in making scribbling blocks. A. Ordinary glue to which about 5 per cent of glycerine has been added is frequently used. A solution of rubber in carbon disulphide is also used. A little aniline is added to the solutions in order to produce the color.

(13) J. T.—The so-called "magic tooth paste" consists of white marble dust, 2 oz.; pumice stone in impalpable powder, 1½ oz.; rose pink, ½ oz.; otto of roses, 7 or 8 drops. Mix with sufficient honey to make a paste. This will rapidly clean the teeth, but it is not adapted for free or frequent use.

(14) D. H. asks if there is any preparation that will stop cracks in a stove, so as to prevent the smoke from escaping, where the heat is great, as in the back of an ordinary grate? A. Take equal parts of sulphur and white lead, with about a sixth of borax, incorporate them so as to form one homogeneous mass. When going to apply it, wet it with strong sulphuric acid and place a thin layer of it between the two pieces of iron, which should then be pressed together. An excellent cement consists of glycerine and litharge stirred to a paste.

(15) A. H. W. asks: What substance is the best for securing the rubber tire to the rim of a bicycle? A. Rubber cement is used, although the tire is sometimes vulcanized on.

(16) C. S. T.—Oxygen gas is given off when potassium chlorate and manganese dioxide are heated together. This operation is generally conducted in a flask to which a delivery tube is attached, and the gas passes through into a convenient receptacle, bubbling up and replacing the liquid already in the vessel. Any text-book on chemistry will show the manipulation better than we can explain it.

(17) P. W. T. writes: How can I stick glass to wood so as to cut it? It must be so that water will not affect it. Also, how can I take it off again? What will polish glass? A. You will find in SCIENTIFIC AMERICAN SUPPLEMENT, No. 158, a great number of waterproof cements, but one that can be easily removed complicates the condition. Will not sealing wax answer? It is not affected by moisture, and a little heat will make it fluid.—Glass can be polished by treating it with fuller's earth, rouge, and like substances with a rag and a little oil.

(18) J. D. asks: 1. Is there any way of restoring the yellowish unbleached color to bleached cotton cloth without weakening the fabric? A. No. 2. Will anything remove ink stains from the dark colored leather of portfolios or book bindings without destroying color? A. Any bleaching agent that you might use will probably affect the coloring matter of the leather. Cannot the spots be washed off?

(19) W. A.—To clean marble from discoloration: Try 2 parts sodium carbonate, 1 of pumice stone, and 1 of finely powdered chalk. Mix into a fine paste with water. Rub this over the marble, and the stains will be removed; then wash with soap and water.

(20) F. V. S. asks how to make a permanent light shade of copper on brass; it looks very pretty and bright when first done, but seems to get much darker; have tried lacquering it, but that does not help it. A. Try dipping or boiling in a saturated solution of sulphate of copper in water, till the desired color is obtained. 2. How to mix kerosene and aniline colors. I have dissolved the anilines in alcohol and also water, but they will not mix; also how to mix shellac with kerosene? A. The best way to do is to purchase the so-called aniline fat colors. These are then directly soluble in kerosene. Shellac is not soluble in kerosene, but by first dissolving it in coal tar benzol, and then mixing this solution with kerosene, your object can be obtained.

(21) C. S. asks how to make a glue or paste which when dry sticks well, retains a pliable condition, and in bulk, corked tight, remains in a liquid state. A. Take a wide mouthed bottle, and dissolve in it 8 ounces best glue in ½ pint water by setting it in a vessel of water and heating until dissolved; then add slowly 2½ ounces strong nitric acid 36° Baume, stirring all the while. Effervescence takes place under the generation of nitrous gas. When all the acid has been added, the liquid is allowed to cool. Keep it well corked, and it will be ready for use at any moment. This preparation does not gelatinize nor undergo putrefaction or fermentation.

(22) C. C. H.—The strength of a ¼ inch belt 6 inches wide, laced, is about 700 pounds. If riveted, about 1,200 pounds; solid, about 2,000 pounds. The amount of horse power a belt will transmit depends so much on speed and size of pulleys as well as tightness that no data can be given for the amount of work a belt can develop, without considering all of the conditions. Three ply rubber belts have a tensile strength of about 600 pounds per inch in width, 4 ply about 800.

(23) W. A. S. asks: 1. Is a one dollar bill issued in 1862 worth any more than its face value? If so, how much? A. It is not worth any more. 2. Is there any operation by which the size of the nose can be reduced? If there is, what is it? A. The size of the nose cannot be reduced in any rational way.

(24) C. C. C.—There are tides in our great lakes, but small, because the lakes are small compared with the ocean.—We have no experience with annealing in ice or soap water. Have always found plain water at ordinary temperature as good as could be desired for black heat annealing.—The more surface you have in the body of a plain cylinder stove, the more radiation.

(25) A. H. P. writes: How can I best keep screw on small steam launch from fouling with weeds? It is a double keel from midship, with curved water way. The wheel is placed within same, and not below said keels. I have not tried this one yet, but very much wish your opinion. We had a steam catamaran, and it fouled badly last year in our creek in getting to the lake. A. This has given a great deal of trouble to the steam canal boats. We fear there is no hope for you unless you invent something.

(26) M. B. asks: What is the cause of bunions or enlarged joints, and what is the best way to get rid of them? A. Bunions are caused by boots or shoes that are too short, producing an enlargement of the joint of the great toe. This enlargement, once produced, will remain permanently on the feet of adults, but all soreness may be removed by the same treatment as used for corns. Only comfortable fitting foot wear will prove a permanent relief.

(27) T. H. De S. writes: Western manufacturers of cooking ranges say that they are obliged to make their wrought iron ranges of heavier material than their Eastern competitors, as the soft or bituminous coal is more destructive to the iron than the anthracite is, because of the excess of sulphur in it. Is this correct? Will not a range last equally as long when using soft as with hard coal? A. The bituminous coal of the Western States has much sulphur, which is destructive to grates and adjacent iron work. The competition among stove and range manufacturers in the Eastern States may also have much to do with the thinness of their castings.

(28) F. C. D. writes: I have a boiler with 39 1¾ inch tubes 20 inches long. This boiler furnishes ample steam for an engine with a cylinder 3x5. Can I heat a building with two rooms, one 15 feet wide, 10 feet high, and 43 feet long, and the other 12 feet wide, 7 feet high and 26 feet long, the boiler to furnish steam for engine at same time? Also, what is the best way to heat it—by radiation or by pipes near the ceiling? If by pipes, do you think that two rows of inch pipe would be sufficient, and if by radiator, how many would I need, and how large? I carry 80 pounds pressure on boiler. A. We recommend you to use exhaust steam for warming your rooms, with a live steam connection, so that you may have steam in the pipes when the engine is not running. Your boiler is large enough for ordinary weather, but in the zero weather you could not run the engine its full duty and heat with live steam. For exhaust you will require 200 feet of 1 inch pipe for the large room and 100 feet of 1 inch pipe for the small room. Let the exhaust blow freely through the pipes. Overhead heating by exhaust is much in vogue; long coils at the sides of the rooms give the best results for small rooms.

(29) F. A. P. asks how punches are tempered for punching iron cold. Have considerable trouble to have punches made that will stand the strain. A. Temper punches in the same manner as you would any tool that is required to be tough and hard. Your trouble probably is not so much in the tempering as in the relative size of the punch and hole in the bed piece. The hole should be larger than the punch according to the thickness of the metal to be punched, say about ⅛ the diameter of the punch.

(30) F. S. B. asks: 1. Why a tin pail will not rust when a piece of zinc is soldered in the bottom of the pail? A. We suppose that the prevention of rust is due to galvanic action. 2. Is there any preparation that will mend what is commonly known as agate ware, sold by hardware dealers? It cannot be soldered, and when broken or cracked it is worthless. A. We know of no successful method of repairing agate ware.

(31) R. W. W. writes: Please inform me if there is any instrument by which I can tell how much distance a man travels in a given time. My men travel on official business, and are paid by the mile; they go on horseback. A. The pedometer is an instrument for measuring a man's step; if the man steps approximately even, or comes down on his feet with the same force at each step, it gives fair results. We think that it would be difficult to so measure a horse's pace. For vehicles there is an instrument sold that is very perfect.

(32) J. P. McN.—Good solders are made from tin and lead in all proportions, from pure tin, which is the strongest, to equal parts of tin and lead, which last is an easy melting solder.

(33) J. J. L. writes: A and B have a dispute: A claims that two ships sailing in the same direction at the rate of one mile per minute, one being one mile behind the other, and a cannon on board the rear vessel capable of throwing a ball at the rate of one mile a minute, in case this is fired at the vessel in the lead the ball will hit the vessel fired at in one minute. B claims it is impossible for the ball to leave the vessel it is fired from. How is it? A. Leaving out the question of gravity, as is necessary, the ball will reach the forward vessel in one minute, because the cannon, being on a vessel that is moving one mile per minute, also moves one mile per minute, and if the ball is discharged from the cannon at a speed of one mile per minute, it will have a speed of two miles per minute in relation to the earth. Otherwise the ball could not leave the cannon, and the dispute is an absurdity.

(34) J. A. W. writes: 1. Does the studying of books on locomotive engineering assist one to learn to be such an engineer? A. Yes, it is very necessary if you would become an accomplished engineer. 2. Would Mexico or South America be a good location for one to follow such a trade? A. Better learn the art of engine driving in the United States, then you will be ready for an opening in any part of the world. 3. What kind of a trade could a young man of this country get or learn in any of those countries? A. There is little to be learned in Mexico or South America in the trades, but good

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openings there are awaiting men who are good workmen here. 4. What are the rates of wages of American or any other countries outside of the United States? A. Wages in Mexico and South America for expert workmen are higher than in the United States. In all other countries wages are low.

(35) G. C. F. writes: I have a small yacht that ran against the rocks and rubbed holes into her sides, from one-quarter to one-half inch deep; and as I do not want to put in new planks or pieces, would like you to tell me what composition I can put in them, to stay, and make a smooth surface, the holes being above water mark? A. Haul out the yacht and turn up the sides, let the wood dry, and with a hot iron melt shellac into the bruised spots. Make the iron hot enough to melt the shellac quickly, but not to burn. Smooth over the surfaces evenly with the iron a little cooler. Finish with a scraper and sand paper. Then paint.

(36) J. R. B.—The plastic asbestos felting will not hold well on a traveling boiler. Use a layer of asbestos paper next the boiler, and cover with hair felt and canvas; leave the front of the boiler naked. You may probably save from 5 to 10 per cent of the fuel by thoroughly felting both boiler, steam pipe, and cylinder. Copper thimbles are used in locomotives. Not used in stationary boilers. The thimbles are rings cut from seamless tubes.

(37) T. P. R. writes: What would be the best method for polishing irregular shaped steel, such as drill points or cultivator points? If with belt, which would be preferable—leather or canvas; and what is the method for applying the emery, and what sized emery will give the best results? Should the glue and emery be mixed before applying, and at what speed should the belt be driven? A. Emery belts are much in use for polishing. They are not economical for the rough surface of iron castings. Steel that is formed in a drop or press, in a die and smooth, may be pickled in muriatic acid and water, which takes the scale off, after which the belt will finish in good style. Use No. 60 emery and the best glue. Spread the glue hot and sift the emery on quickly and as thick as the glue will hold. The best way is for two persons to do the work—one to spread the glue and the other to follow with the emery as close as possible to the brush. If the points are hardened, a coarser grade of emery is preferred—50 or 40.

(38) C. S. S. writes: I have a small horizontal boiler 2 feet in diameter, 3¼ feet long, with 26 two inch flues running the full length; the flues are put in one-half of the heads. Can I use it as an upright as it is, or shall I have to put flues in the other half, and if so, how many? I think there is heating surface enough for my engine as it is; engine is 3 inches diameter by 5 inches stroke. How much power will it develop with 60 pounds steam, running 300 times a minute? A. If you set your boiler horizontally, as its make was intended, it will be 3 horse power. If you set it upright, it will be necessary to fill the space with tubes laid out in the same way as those already in, to make it 3 horse power. It will only make a poor boiler at that, as you will then have to make a brick firebox. Grate should be 14 inches from shell in either case. Your engine will develop about 2½ horse power. Use ¾ inch steam pipe, 1 inch exhaust, smoke stack 8 inches diameter, 15 feet high. 2. Could I make a larger dynamo than the one described in SUPPLEMENT, No. 161, from the descriptions given in it, and if so, what proportion should it be to require 2 full horse power to run? A. For a larger dynamo, such as you ask for, you had better consult some of the establishments in the electric light business.

(39) F. O.—We could not undertake to instruct you in making an air gun. It requires a skillful mechanic in gun work to make these guns. A few hints will be of no value. You will find them described and illustrated in Knight's "Mechanical Dictionary." You may also obtain drawings of a number of patents on air guns from the Patent Office for a fee. We think that you could make a windmill that would drive your fret saw, and for this also you could find a variety of ways, according to your location and facilities.

(40) R. E. writes: Please let me know if I would get any more speed out of my boat by using a smaller propeller wheel—using 24″ now, 3′ pitch—engines 3″ x 3½″, coupled, or if I would be better with a two-bladed one, boat 30′ long, 5′ 10″ beam? Can make between 6 and 7 miles now, but think I ought to do more. Also let me know if boiler is large enough, size 26″ diameter, 4′ high, 32 two inch tubes 22″ long? A. Your wheel is about right. A smaller wheel would have to run much faster, and be subject to more slip. If your boiler and engines are running up to their capacity, you could only improve by making the wheel larger, and very little at that, unless you also increased the engine power. Three-bladed wheels are preferred for this class of launches. You are making very good speed. Boiler is probably large enough. You do not give speed of engine when making 7 miles an hour, nor pressure in boiler—all essential points to know in giving an opinion as to proper proportions.

(41) J. A. D. writes: Take three pieces of metal: first a standard silver dollar; second, piece of gold; third, piece of platina; to be precise in measurement, they shall each be struck in the die of the silver dollar. Question: Which of these pieces will displace the most water when immersed? J. M. says the gold piece will displace more than the silver, and the platina will displace more than the gold. J. D. maintains the displacement will be the same, as bulk causes the displacement, and not specific gravity, which I understand J. M. to maintain. A. J. D. is right.

(42) C. H. C.—We could not undertake in this place to attempt an explanation of the phenomena of alleged spiritual manifestations, or even a definition of what is claimed in this line.

(43) E. S. writes: I have an instrument of music called the Musical Cabinet, for which I paid $80. It performed very well at first, but it soon got to fray the edge of the paper on the bass side, and did not re-roll true. I should like to know how to prevent it if possible? A. Get a piece of roll drawing paper, and cut a new sheet; this can be done by taking out the old one and using it for a pattern, marking the holes with a pencil. Cut on a board with a knife.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined with the results stated.

E. M.—Sample No. 1 consists of hematite or specular iron ore, sometimes called micaceous iron ore. No. 2 is simply a metallic plate of the same a little larger than the majority of the plates in the first sample.—R. S. H.—The deposit is calcium carbonate, and it is soluble in acids.

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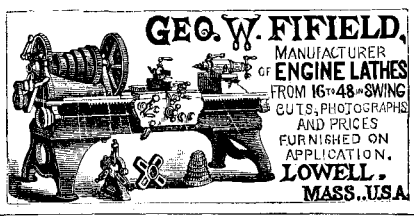
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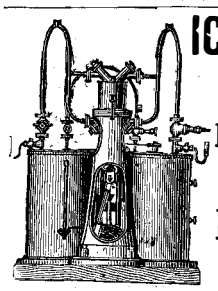
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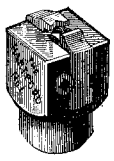

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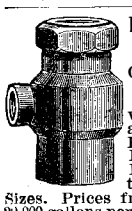

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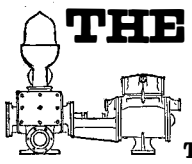

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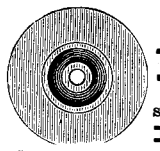

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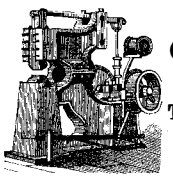

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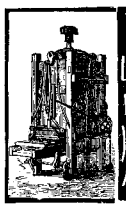

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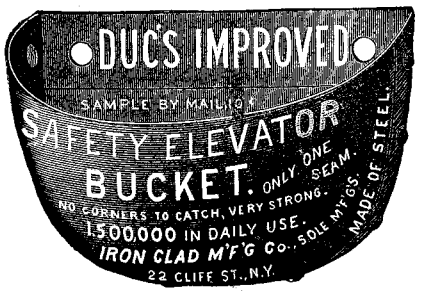
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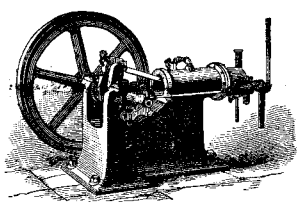

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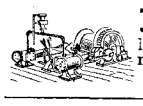

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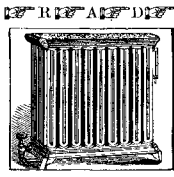

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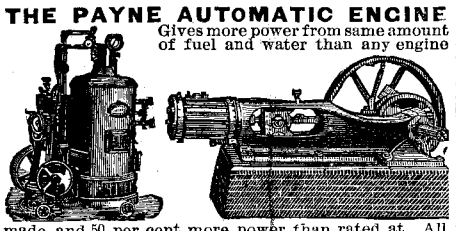

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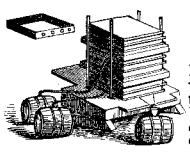

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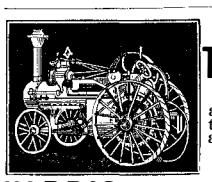

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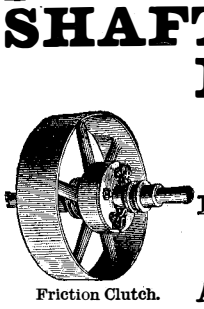

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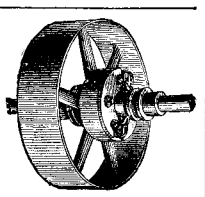

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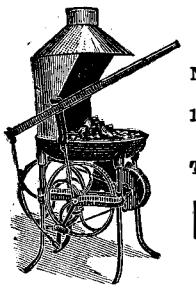

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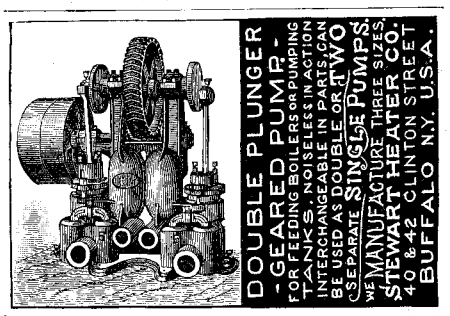
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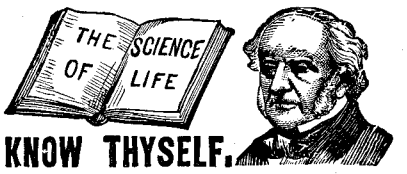

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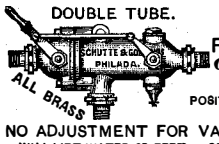

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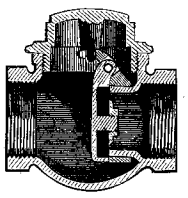

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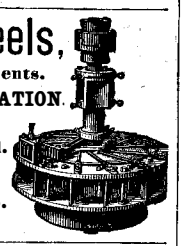

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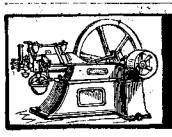

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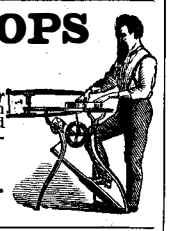

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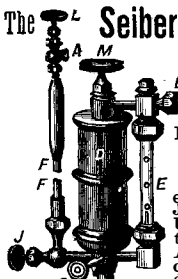

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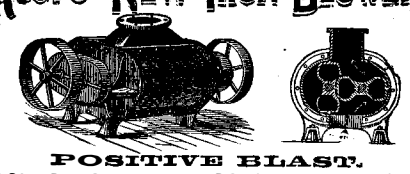

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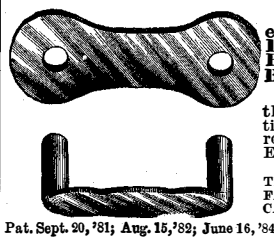

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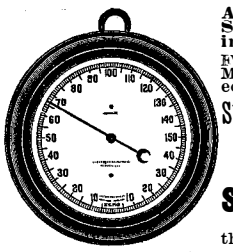

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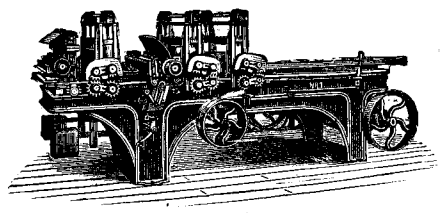

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